151791

PHASE II
SUPPLEMENTAL INVESTIGATION
WORK PLAN
ENVIRO-CHEM SUPERFUND SITE
ZIONSVILLE, INDIANA

PREPARED FOR:

ENVIRONMENTAL CONSERVATION AND CHEMICAL CORPORATION TRUSTS

PREPARED BY:

AWD TECHNOLOGIES, INC.
INDIANAPOLIS, INDIANA

AWD PROJECT NUMBER 2259.820

DECEMBER 1992

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1.0 INTRODUCTION

This Phase II Supplemental Investigation Work Plan has been prepared by AWD Technologies, Inc. (AWD) on behalf of the Environmental Conservation and Chemical Trusts (Enviro-Chem) for the Enviro-Chem Superfund Site in Zionsville, Indiana. The Phase II scope of work is proposed to more accurately estimate the water management requirements not yet anticipated and their impact on the remedial design process.

The potential need for dewatering related to the Soil Vapor Extraction System (SVES) design was identified through the Phase I Supplemental Investigation (SI) (AWD, October 1992). The Phase I SI identified the fact that the water table at the site is significantly elevated compared to prior investigations. In addition, preliminary dewatering calculations were made to estimate the volume of groundwater that might be removed (AWD, October 1992). Those calculations estimated that approximately 750,000 gallons of groundwater would have to be initially removed from storage within the remedial boundary, and a steady-state flow rate of 1.5 gallons per minute from the dewatering system would be required to maintain an appropriate vadose zone.

Because of the uncertainty of the hydraulic parameters of the till unit within the remedial boundary, and the potential hydraulic influence of the underlying sand and gravel unit, the preliminary calculations were thought to be accurate within one order of magnitude. Therefore, the predicted flow rate (under steady-state conditions) could vary from approximately less than 1 to 15 gallons per minute. A more accurate estimate of the water volume is necessary to assess the options for water management, and to identify, as early as possible in the design process, the limitations of, and potential design revisions to, the presently proposed remedial alternative. These design revisions, if necessary, would be required to prepare a constructable and biddable design package that would permit the procurement of bids, and the performance of the remediation within a reasonable range of the estimated cost.

2.0 OBJECTIVES

The objectives of the Phase II Supplemental Investigation are:

- To more accurately estimate the volume of stored groundwater to be removed and the maintenance dewatering rate necessary to operate the proposed SVES.

- To assess the hydraulic interconnection between the upper till unit and the sand and gravel unit.

- To determine the feasibility of dewatering through trenches similar to the pilot study soil vapor extraction trenches.

- To evaluate the physical stability of an open trench excavation.

The construction of the dewatering trench, performance of hydraulic testing, and estimation of the stored groundwater and steady-state flow rate as presented in this work plan are contingent on the ability to excavate a stable trench down to a depth of 9 feet. If this cannot be achieved because of sediment instability or much greater than anticipated groundwater inflow, (i.e., the trench or test pit cannot be easily dewatered to continue construction), then the scope of work and schedule will be changed accordingly.

The Phase II Supplemental Investigation is intended to provide sufficient data for implementation of the proposed remedial measures. The successful completion of that intention is contingent on the feasibility of constructing the dewatering trench and performing the hydraulic testing as proposed. Based on the existing data, there is potential for site conditions to warrant major design modifications to the proposed remedial measures. If such conditions are encountered, they will be communicated immediately to U.S. EPA and the necessary changes in scope will be discussed prior to completion of the presently proposed scope of work.

3.0 SCOPE OF WORK

The proposed scope of work consists of eight primary tasks. The proposed tasks include the following:

- Task 1 - Work Plan Development
- Task 2 - Mobilization
- Task 3 - Dewatering Trench Excavation and Construction
- Task 4 - Observation Piezometer Installation
- Task 5 - Dewatering Trench Hydraulic Testing
- Task 6 - Backfill and Cover Trenches
- Task 7 - Surveying
- Task 8 - Phase II Supplemental Investigation Data Evaluation and Summary Report

3.1 Task 1 - Work Plan Development

This task consists of the initial planning of the scope of work and the logistics of completing that scope of work. It includes the development of this work plan, the development of the site-specific health and safety plan, procurement and coordination of subcontractors (including the drilling subcontractor and analytical laboratory), and coordination with the adjacent landowners (i.e., Northside Sanitary Landfill and Boone County Recycling). A preliminary schedule was also developed during this task; it is presented in Section 6.0 of this work plan.

3.2 Task 2 - Mobilization

Mobilization for the proposed scope of work will be performed immediately prior to beginning Task 3. It will generally involve the following:

- Mobilization of excavation equipment to the site
- Mobilization of water and solid waste storage containers to the site
- Temporary decontamination pad construction
- Construction materials delivery for the dewatering trenches
- Manpower mobilization

3.3 Task 3 - Dewatering Trench Excavation and Construction

This task will consist of the excavation of two test pits and construction of one pilot scale dewatering trench. The proposed locations of the test pits and dewatering trench are presented in Figure 1. One of the test pits will be excavated through the concrete pad and the other will be excavated at the approximate center of the proposed dewatering trench. Each test pit will be approximately 5 feet in length, 5 feet in width, and (as a target depth) 9 feet deep.

Each test pit will be logged by an experienced hydrogeologist. Groundwater inflow will be documented on the geologic logs with a relative estimate of the inflow rate. Photographs of encountered conditions will be taken at each test pit.

Excavation of each test pit will stop at a depth of 9 feet or less depending upon encountering the following conditions:

- Collapse of the test pit walls that undermines the sidewalls or does not allow the trench/test pits to be excavated to 9 feet..
- A groundwater inflow rate that exceeds the rate at which the test pit may be excavated.
- Interception of unanticipated subsurface debris such as buried drums, etc.
- Inflow of significant amounts of light nonaqueous phase liquids (as encountered in PZ-7 and PZ-8 during the Phase I Supplemental Investigation).
- Interception of environmental conditions requiring supplied air for personal health and safety (Level B). Note that these conditions are explained in the site-specific health and safety plan.

If the first two conditions are encountered, a reevaluation of the scope of work for Task 4 will be necessary. The occurrence of physically unstable test pit walls or greater than expected groundwater inflow rates may indicate that the pilot dewatering tests cannot be easily performed through a dewatering trench and alternate dewatering methodologies may have to be employed. If the other conditions are encountered (depending on their extent), only minor modifications to

the scope of work and schedule will have to be made prior to performing the remainder of the proposed scope of work.

The test pit completed in the concrete pad will be left open for observation until completion of the dewatering trench. Pumping of groundwater from the open test pit will then be performed during pumping of the dewatering trench.

The dewatering trench will be excavated by elongating the second test pit. The dewatering trench is planned to be 50 feet in length and approximately 9 feet deep with a slight slope west to east. This slope (2 percent) will induce groundwater flow to the eastern end from which the groundwater will be pumped during hydraulic testing (Task 5).

The base of the dewatering trench will be backfilled with a thin layer of gravel. Four-inch, corrugated, perforated 4-inch HDPE drain pipe will be laid along the entire length of the trench on top of the gravel base. The 4-inch HDPE drain pipe will have 0.125-inch slot openings that are positioned at six equally spaced intervals around the pipe (every 60 degrees). The slots will be 1.25 inches in length with each group of slots separated by a solid section.

At the sump end, the 4-inch drain pipe will be connected to a minimum 6-inch standpipe with a "sump end" extending below the base of the drain pipe. Groundwater pumping will be performed out of this standpipe. The 6-inch standpipe will be constructed of schedule 80 PVC. Figure 2 presents a cross section of dewatering trench construction details.

In addition to the sump-end standpipe, one 4-inch piezometer will be placed within the dewatering trench in line with the locations of the planned observation piezometers. The 4-inch piezometer will be held in place with stabilization wires during trench backfilling. Figure 3 shows construction details of the trench piezometer.

The dewatering trench will be backfilled to within 2 feet of grade with gravel, and the remainder of the trench will be backfilled with excavated soil to grade. The gravel backfill will consist of fine washed gravel, of which 100 percent will pass the No. 3/8 sieve (0.375 inches) and less than 15 percent will pass the No. 4 sieve (0.187 inches). Plastic sheeting will be used to cover the trench after backfilling to prevent surface precipitation/runoff from entering the trench.

3.4 Task 4 - Observation Piezometer Installation

Observation piezometers will be installed in the upper till unit, and in the sand and gravel unit, to monitor the effects of pumping from the dewatering trench. One set of piezometers will be installed along the trench as presented in Figure 1.

The set of piezometers along the trench will consist of three piezometers screened in the upper till unit and one piezometer screened in the sand and gravel unit. Two of the till unit piezometers will be positioned on opposite sides of the trench at (approximately) 10 feet from the walls of the trench. The third till unit piezometer will be located 10 feet further away from the trench, in line with the other two till piezometers. The sand and gravel unit piezometer will be placed at an equivalent distance from the trench opposite the third till unit piezometer.

Each piezometer will be constructed of 2-inch PVC well screen and riser pipe (Section 4.3.2). Well screen length will be no greater than 5 feet. The sand and gravel unit piezometer will be screened across the upper 5 feet of the waterbearing, more coarse grained sediment.

Sampling of the upper till unit and sand and gravel unit will be performed for geotechnical description during drilling of the observation piezometers. Continuous split spoon samples will be taken and logged by the onsite hydrogeologist.

The existing eight piezometers on the concrete pad will be used to observe hydraulic effects from pumping out of the open test pit. These piezometers are shallow (up to 6 feet deep) and are reported to be screened up to 1 foot below ground surface.

3.5 Task 5 - Dewatering Trench Hydraulic Testing

Hydraulic testing will be performed on the dewatering trench and the open test pit on the concrete pad to more accurately estimate the flow of groundwater necessary to dewater the area within the remedial boundary. The testing will consist of the constant rate discharge of water from the trench for a minimum of 3 days pumping and from the test pit for a shorter time period. Pumping from the test pit will be limited to determining the short-term discharge rate available from the shallow sediment under the concrete pad.

A submersible pump will be installed in the standpipe at the sump end of the trench and a sump pump will be used to pump directly out of the test pit. Power will be provided by an onsite generator.

Prior to pumping, water levels will be measured from the observation piezometers and other (nearby) existing monitoring wells to establish "background" or static conditions. Water level measurements will be taken periodically throughout the pumping period to evaluate the effects of dewatering. Both remote measurements (with pressure transducers) and manual water level measurements will be made.

The flow rate out of each trench will be controlled through an aboveground flow meter and gate valve. Discharge water will be collected in at least one onsite 20,000 gallon storage tank (frac tank) and several smaller, portable storage tanks. A target flow rate of between 1 to 15 gallons per minute is planned for the testing. The pumping rate will be adjusted so that hydraulic influence can be measured in the observation piezometers while maintaining, at a minimum, enough water in the trench and the test pit to fully cover the intake screen of the pumps.

At completion of the pumping, two composite samples of the stored water will be collected. One of the samples will be analyzed for the compounds in Table 3-1 of Exhibit A (Appendix A) of the site Consent Decree for comparison to the existing data base. The second sample will be used in preparation for final treatment/disposal of the stored water.

3.6 Task 6 - Backfill and Cover Trenches

Upon completion of the hydraulic testing, the temporary plastic cover over the dewatering trench will be left in place and the trench will be covered by excavated soil. The test pit will be backfilled with excavated soil to grade. Backfilled soil will be mounded to induce runoff away from the trench and the test pit. The mounded soil will be covered with plastic sheeting that will be left in place under the proposed cap. The plastic sheeting cover will be secured by placing reinforced plastic bags of excavated soil along the perimeter of the sheeting. The bags of soil will also be incorporated under the proposed cap.

3.7 Task 7 - Surveying

The horizontal and vertical positions of the installed observation piezometers will be surveyed for incorporation onto the site location map. The locations and dimensions of the dewatering trench and the test pit will also be surveyed. The surveying will utilize the benchmark located by Schneider Engineering Corporation along State Route 421, TBM No. 4, Elevation 890.550. Vertical control will be maintained with a level with reference back to the identified benchmark.

The ground surface elevation and top of casing elevation will be recorded from each observation piezometer. These data will allow for comparison to existing groundwater data and the calculation of steady-state flow estimates based on observed water level reaction during the hydraulic test of the dewatering trench.

3.8 Task 8 - Letter Summary Report

Data reduction and evaluation will begin during the field activities. Upon completion of Task 5, analysis of the hydraulic testing data will be performed. A letter report will be developed for the Phase II Supplemental Investigation that will provide the following:

- Hydraulic testing results
- Physical stability of open trenches
- Dewatering flow rate estimate

4.0 FIELD TESTING METHODOLOGIES

The data necessary to meet the objectives of the Phase II Supplemental Investigation will be obtained from the following:

- Test Pit Excavation
- Dewatering Trench Construction
- Test Boring and Observation Piezometer Installation
- Soil Sampling Techniques
- Hydrogeologic Testing
- Analytical Sampling of Stored Water

Section 4.0 describes these investigational methodologies and also presents an outline of other project activities including purge water storage and handling, equipment decontamination, and field recordkeeping.

4.1 Test Pit Excavation

Two test pits will be excavated within the remedial boundary as shown in Figure 1. The pits will be excavated to a depth of approximately 9 feet below ground surface with a standard backhoe. One of the test pits will be elongated to construct the dewatering trench and the other (on the concrete pad) will be left open for direct pumping.

The test pits will be logged by an experienced hydrogeologist through observation of material in the backhoe bucket. No entrance of the test pits is planned (or needed). As explained in Section 3.0, excavation will stop if collapse of the test pit walls occurs. This scope of work does not include provisions for structural bracing of the test pits.

Material excavated from the test pits will be temporarily stockpiled on a plastic tarpaulin next to the excavation. The temporary soil stockpiles will be covered after each work day to minimize blowing of contaminated soils, erosion/transport of sediments in storm water runoff, and volatilization of organic compounds. Soil piles which remain stockpiled for an extended time period will also be covered with a plastic tarpaulin. The plastic cover used to cover the temporary soil stockpiles and the dewatering trench will be a minimum 9 mil thick, composite

laminate with a cold crack rating of -50°F and a UV resistant rating. Barriers shall be constructed around test pits to prevent accidental trespass.

Soil and groundwater samples will be removed from the test pits for observation and field screening purposes. The means of sample collection will include using a soil auger, telescoping poles, and removing samples directly from the backhoe bucket. Encountered groundwater conditions will be documented pertaining to where water was first encountered, estimated formation yield, and identification of confining layers.

4.2 Dewatering Trench Construction

One pilot scale dewatering trench is to be constructed near the northern perimeter of the site (upgradient end). It is planned to be 50 feet in length and approximately 9.0 feet deep. The trench will be approximately 1.5 feet in width.

The excavated soil from the trench will be stockpiled in a predetermined location within the fenced area. The soils have to be removed from the area adjacent to the trench to allow for drilling of the observation piezometers. The stockpiled soil will be laid on plastic sheeting and will also be covered by a UV resistant plastic tarpaulin after completion of the excavation.

A construction trash pump(s) will be used during excavation (if warranted) to dewater the test pit and the trench during construction. The discharge water will be pumped into the temporary, onsite storage tanks that will be staged adjacent to the trench and the test pit.

Upon completion of trench excavation, a thin layer of gravel (maximum 6 inches) will be placed at the base of the trench. Four-inch corrugated, perforated HDPE drain pipe will be assembled at ground surface and laid along the entire length of the trench. The HDPE drainage pipe will have slot openings of 0.125 inches distributed at 60 degree intervals around the pipe. At the sump end of the trench, the drainage pipe will be connected to a minimum 6-inch schedule 80 PVC standpipe with a tee connector. The standpipe will have a sump end that will extend a minimum of 1 foot below the level of the drain pipe (Figure 2).

A 4-inch PVC piezometer will be placed within the dewatering trench. The piezometer will be held in place with guidewires that will be attached to the upper few feet of the riser pipe. The

guidewires will serve to keep the piezometer perpendicular to the base of the trench during gravel backfilling.

The trench will be backfilled to within 2 feet of ground surface with gravel and from ground surface to the top of the gravel with excavated soil. The gravel backfill will consist of fine washed gravel of which 100 percent will pass the No. 3/8 sieve (0.375 inches) and less than 15 percent will pass the No. 4 sieve (0.187 inches). A plastic cover will be placed over the length of the trench. After placement of the temporary cover, the trench piezometer and the sump end standpipe will be left protruding above ground surface. Groundwater pumping will be performed out of the sump end standpipe and water level observations will be taken from the piezometers prior to, and during, pumping.

The temporary cover will be left in place after completion of hydraulic testing. The trench will be covered with the excavated soil. The soil cover will be mounded to induce runoff away from the trench and covered with a UV resistant plastic tarpaulin. This closure will be sufficient until the final remedial cap is placed over the entire remedial area.

Pumping will also be conducted directly out of the open test pit. Closure of the test pit will be similar to that for the dewatering trench.

4.3 Test Boring and Piezometer Installation

4.3.1 Test Boring Drilling

The scope of Task 4 calls for the installation of four observation piezometers, of which three will be in the upper till unit and one will be in the sand and gravel unit.

All drilling will be performed according to the drilling, sampling, and well installation Standard Operating Procedures (SOPs) as presented in Appendix B. The drilling rig will be equipped with, and capable of, drilling with hollow stem augers (HSA) up to 6 1/4-inch inside diameter and be able to convert to fluid rotary drilling. A truck mounted drilling rig such as a Mobile Drill B-53 will be used to drill all of the proposed test borings. Drilling depth is anticipated to extend, at a maximum, to 25 feet below ground surface.

When using HSA, the inner diameter of the auger will be a minimum of 4 inches greater than the maximum outside diameter of the piezometer to be installed. The HSA will be equipped with either a center plug or knock out plug attached at the drive auger. The plug will be removed for each split-spoon sample and prior to piezometer installation. Each piezometer will be installed through the auger string. In the case of caving sands, a positive pressure head of clean water or bentonite slurry will be used within the augers. Where possible, HSA with no additive fluids will be used in order to optimize observation of groundwater conditions.

Fluid rotary drilling will only be used if providing a positive pressure head (of water or bentonite slurry) in the augers does not stop the caving of subsurface sediments. The caving of sediments is a distinct possibility when installing the observation piezometer in the sand and gravel unit.

4.3.2 Observation Piezometer Construction

In general, observation piezometer construction will consist of threaded flush joint 2-inch PVC riser pipe and continuous slot (wire wrap) 2-inch PVC screen. The screen lengths will be a maximum of 5 feet. The PVC well screen will have 0.01-inch openings for the upper till unit and 0.02-inch openings for the sand and gravel unit. Final well design will be determined from field data including split-spoon sample observations.

Filter pack, annular seal, and grout is to be emplaced manually within the annular space. Augers/casing will be simultaneously extracted as material is poured into place. The filter pack material will consist of clean non-carbonate sand possessing a grain size compatible to the screen slot size and formation characteristics. Filter pack will be emplaced to a minimum of 2 feet above the screen in the upper till unit piezometers and up to the top of the sand and gravel unit in the sand and gravel piezometers. A minimum 2-foot bentonite seal will be emplaced above the filter pack, followed by a cement-bentonite grout to the surface. No outer protective casing will be used because the piezometers are not intended for long term use or chemical monitoring. Figures 4 and 5 present construction details for the upper till unit and sand and gravel unit piezometers, respectively.

The observation and dewatering trench piezometers will be left in place upon completion of the Phase II Supplemental Investigation. Abandonment of the piezometers will be performed when the onsite monitoring wells are abandoned prior to cap placement.

4.4 Soil Sampling Techniques

Continuous soil samples will be collected at each borehole location. Soil sampling will provide a full lithologic profile of the study area and allow further detail of the upper till unit lithology. Soil samples will be obtained using the split-spoon sampling method. Standard penetration tests will be conducted according to the American Society for Testing and Materials (ASTM) specification number D1586.

The soil samples will be logged by the onsite hydrogeologist according to the Unified Soil Classification System (USCS). A complete description of each sample will be recorded in the field according to physical characteristics that will include density and consistency, color, and grain size. Other distinguishing features such as moisture content, stratification, texture, fabric, and bedding will be noted as appropriate. Soil samples will be containerized in jars, and photoionization detector (PID) or flame ionization detector (FID) with methane filter headspace readings will be taken to determine the potential presence of volatile organic compounds (VOCs) or semivolatile organic compounds (SVOCs). The headspace measurements will provide a check of the contaminant distribution as described in the existing data base.

4.5 Hydrogeologic Testing

The scope of work will include two constant rate pumping tests; one out of the proposed dewatering trench and a shorter duration test out of the open test pit on the concrete pad. The tests will be performed simultaneously. The tests will consist of the sustained pumping of water from each trench with observation of water levels in the trench piezometer, the installed observation piezometers, and the existing concrete pad piezometers. Background water levels will be taken, at a minimum, on two occasions prior to, and immediately before, each test. The tests will be performed to more accurately estimate the discharge rate needed to maintain dewatered conditions in the upper 9 feet of sediment within the remedial boundary.

The sump-end standpipe of the trench will be equipped with a submersible pump and discharge hose; a sump pump will be used in the test pit. Power will be supplied by a gasoline generator. The pumping test water will be discharged into the onsite storage tanks utilized for construction dewatering. The constant rate pumping is anticipated to be performed between 1 and 15 gallons per minute.

The constant rate pumping test of the dewatering trench will be performed for no less than 72 hours or until field data evaluation shows that the critical point for data evaluation has been reached (i.e., enough drawdown to extrapolate a steady-state flow rate on the dewatering trench). Real-time analysis of data will be performed in the field. Drawdown curves will be produced to monitor the progress of each pumping test. Pumping from the test pit will be stopped after a short-term discharge rate is determined.

The discharge rate (Q) will be measured with a calibrated flow meter and checked periodically to confirm that a constant rate is maintained. The nearest observation piezometer to each pumping location will be measured remotely with a 20 psi pressure transducer and data logger to provide detailed drawdown data. Manual water level measurements will be made on the other observation piezometers.

4.6 Analytical Sampling of Stored Water

Two composite samples of the stored groundwater will be collected at the end of hydraulic testing.

The sampling will be performed by taking a bailer sample from each of the storage tanks. The samples will then be composited from each of the bailers. The first sample will be analyzed for the compounds listed on Table 3-1 of Exhibit A (Appendix A) to compare to the existing data base. The second sample will be analyzed as a fingerprint analysis for treatment and disposal information. Chain of custody and documentation procedures are described in Section 4.9.2.

4.7 Purge Water Storage

All construction dewatering and pumping test discharge water will be stored onsite in 20,000 gallon, closed top storage tanks (frac tanks) or smaller, portable storage tanks. The frac tanks will be used to store all water after completion of the Phase II SI.

Because of the projected schedule for the Phase II SI field activities, provisions will be made to prevent freezing of the discharge water during hydraulic testing. If necessary, the frac tanks will be heated by propane heaters to prevent freezing. Temporary housing with kerosene heaters will be used to warm the flow meters and flow rate adjustment valves at the well head (ground surface). Due to the short duration of the testing, and the continuous nature of the testing, there

are no provisions for heat tracing or permanent insulation of the discharge hosing. If a failure occurs that stops pumping, the discharge hoses will be purged immediately with compressed air to prevent ice clogging.

After the "fingerprint analysis" is completed, the water will be transferred into vacuum trucks for transportation to the selected permitted commercial treatment facility. The tanks will be steam cleaned prior to removal from the site. Note that the estimated costs for the Phase II SI do not include costs for commercial disposal.

4.8 Equipment Decontamination

All construction and drilling equipment will be decontaminated prior to and upon completion of work within the remedial boundary. Pressurized steam cleaning will be utilized to remove contaminated materials, oils, and grease from downhole drilling equipment, tools, and drill rigs.

Decontamination will be accomplished at a temporary decontamination station (decon pad) that will be constructed during Task 2 of the Phase II Supplemental Investigation. It will be located within the fenced portion of the remedial boundary, and is presently proposed to be located on a portion of the existing concrete pad adjacent to the existing drum storage area.

All solid wastes will be containerized in U.S. DOT-approved 55-gallon drums. The solids will be staged next to the existing drums, and will be removed during the site preparation task prior to remedial construction.

All decontamination water will be collected in a temporary sump on the decon pad. Liquid will then be pumped from the sump into one of the temporary storage tanks.

4.9 Field Recordkeeping

4.9.1 Field Logbooks

Onsite personnel will maintain a bound, weatherproof logbook. Entries for each field activity will be made at each location and will include all field measurements, observations, and information recorded on sample labels. The onsite hydrogeologist or designee for each task will record information in this logbook.

The onsite Health and Safety Officer shall maintain a logbook detailing health and safety equipment use, calibration, and monitoring results.

A site logbook will be maintained at the project field office (temporary trailer). This logbook will contain a summary of the day's activities, including a site visitors log and health and safety equipment use reports. This logbook will be updated daily. A separate logbook will also be maintained in the field office for all environmental media samples.

4.9.2 Geotechnical and Chemical Sample Documentation

The following documents will be prepared in order to identify and track each sample through shipping and laboratory analysis:

- Sample labels stating project number, project name, samplers name, sample medium, preservative, type of sample (grab or composite), sample number, location, date, and time.

- Chain of custody forms stating sample type, container, preservative, sample location, analysis, laboratory, date/time collected, date/time shipped, and collector/shipper name.

- Overnight carrier air bills.

- Sample logbook.

A chain-of-custody example is illustrated in Appendix C.

Proper chain-of-custody procedures will be followed to maintain sample possession. The samples must be traceable from the time the samples are collected until they or their derived data are used as evidentiary material in enforcement or other regulatory proceedings. A sample is considered being under custody if any of the following conditions are met:

- It is in the possession of the sampler.
- It is in plain view, after being in possession.

- It was in possession and is secured (locked up).
- It is in a designated secure area.

The sampler will be personally responsible for the care and custody of the samples collected until they are properly transferred or dispatched. All sample labels and chain-of-custodies shall be completed in waterproof ink.

Transfer of custody procedures are outlined below:

- A chain-of-custody record is completed when transferring possession of samples. The relinquishing party (the sampler) and the receiving party (the laboratory representative) will sign, date, and note the time on the record. This form documents sample custody transfer for the samples through a courier to the sample custodian at the receiving laboratory.

- The original chain-of-custody form will accompany the samples, and the project manager will retain a file copy.

- Upon receipt of the samples, the authorized laboratory representative (sample custodian) will initial the sample numbers on the chain-of-custody forms and inform the project manager of any discrepancies.

4.9.3 Hydrogeologic Test Data Records

Necessary data from the pumping tests will be measured remotely with pressure transducers/data loggers and by manual water level meters. All pertinent data will be recorded on permeability test data sheets (Appendix D). The data typically recorded will include:

- Weather including barometric pressure
- Test time
- Initial water level
- Test interval water level

The data sheets will be kept in a site-specific aquifer testing log. Since real time evaluation of the data is planned, parameters such as drawdown and change in water elevation over time will

be calculated and recorded directly on the data sheets. Data analysis in the field will include development of time drawdown curves to estimate hydraulic conductivity and quickly evaluate the performance of the particular hydraulic test.

5.0 HEALTH AND SAFETY PROVISIONS

A site-specific health and safety plan (HASP) has been developed for this project. It is provided as Appendix E. The HASP provides a description of the following:

- Personnel Organization and Responsibilities
- Hazard Assessment
- Site Control Measures
- Personal Protective Equipment
- Air Monitoring Requirements
- Decontamination Procedures
- Health and Safety Standard Operating Procedures
- Accident Prevention Plan
- Emergency Response Planning
- Health and Safety Recordkeeping

According to existing site data, all invasive work at the site is anticipated to be performed in Level C personal protective equipment.

6.0 SCHEDULE

Tasks 3 and 4 will require 6 to 7 working days. Task 5 will begin as soon as practicable after completion of the dewatering trench construction and piezometer installation. It will require, at a minimum, 1 working week.

Data reduction and evaluation will be performed over a 4- to 6-week period. The draft Phase II Supplemental Investigation Summary Report will be issued approximately 2 months after completion of the field activities.

The revised schedule is to mobilize and begin field work by January 6, 1993. The field activities (Tasks 3, 4, 5, 6, and 7) will be performed from January 6 through January 27, 1993. The draft summary report is then scheduled to be issued on March 15, 1993.

Figure 6 presents a bar chart depicting the revised schedule.

8.0 REFERENCES

1. 1992 (October), Phase I Supplemental Investigation Summary Report - Enviro-Chem Superfund Site, AWD Technologies, Inc., 11 pp.

2. 1988 (July 8), Interim Report of Vapor Extraction Pilot Test; Environmental Resources Management - North Central, Inc. in Attachment No. 1 of Exhibit A of Site Consent Decree, 7 pp.

FIGURES

FIGURES

NORTHSIDE SANITARY LANDFILL

UNNAMED DITCH

FINLEY CREEK

REMEDIAL BOUNDARY (TYP.)

EXISTING SUMP

TEST PIT

CONCRETE PAD

DEWATERING TRENCH

DRUMS

GATE

CONCRETE AND GRAVEL ROAD

SOIL VAPOR EXTRACTION SYSTEM PILOT STUDY AREA

TEMPORARY DECON PAD

STORAGE TANK AREA

POND
"THIRD SITE"

EXISTING FENCE

INDUSTRIAL BUILDING

BANKERT RESIDENCE

BOONE COUNTY RECYCLING OFFICE

STATE ROAD 421

LEGEND

- TEST PITS
- UPPER TILL PIEZOMETER
- SAND & GRAVEL UNIT PIEZOMETER
- DEWATERING TRENCH PIEZOMETER

0 100 200
SCALE IN FEET

FILE: \ECC\TESTPIT

0924920V

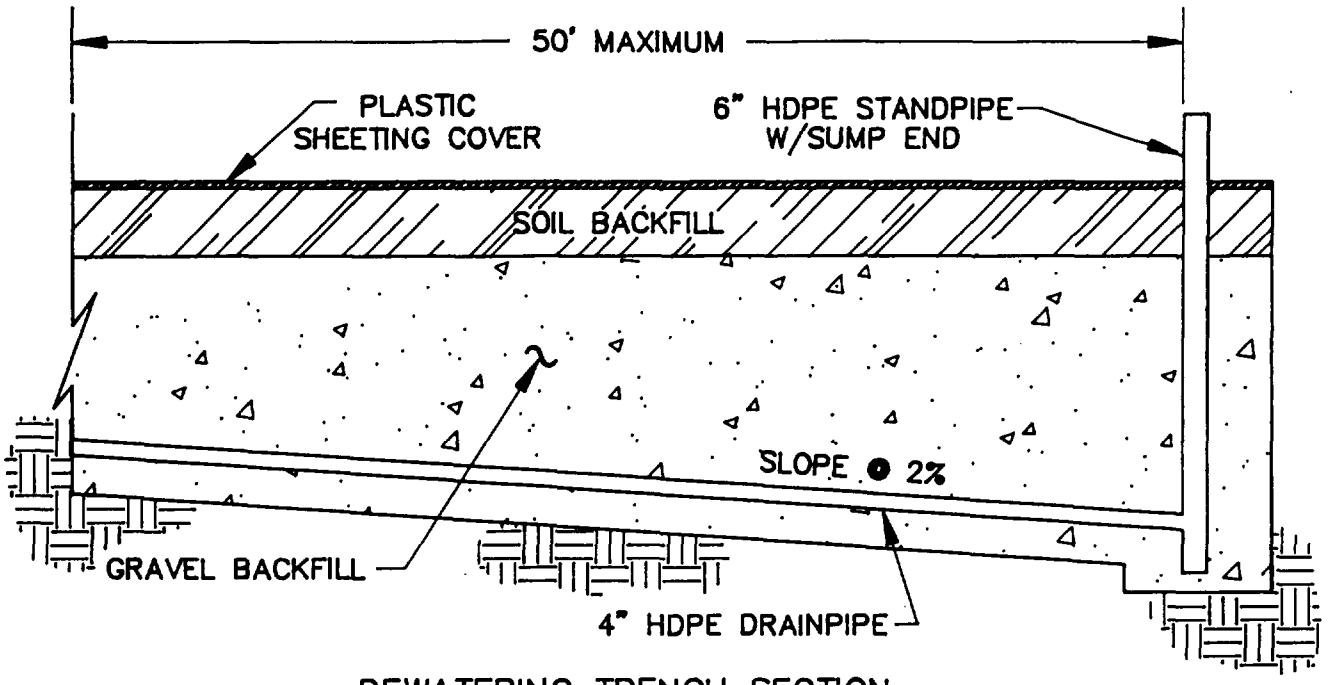
AWD TECHNOLOGIES, INC.

AWD TECHNOLOGIES

PROPOSED TEST PIT, DEWATERING TRENCH AND OBSERVATION PIEZOMETER LOCATIONS

ECC SUPERFUND SITE — ZIONSVILLE, IN

CLIENT: ENVIRONMENTAL CONSERVATION & CHEMICAL CORP. TRUST		JOB NUMBER: 2259-820
SCALE: AS SHOWN	FIGURE NUMBER 1	REV 0



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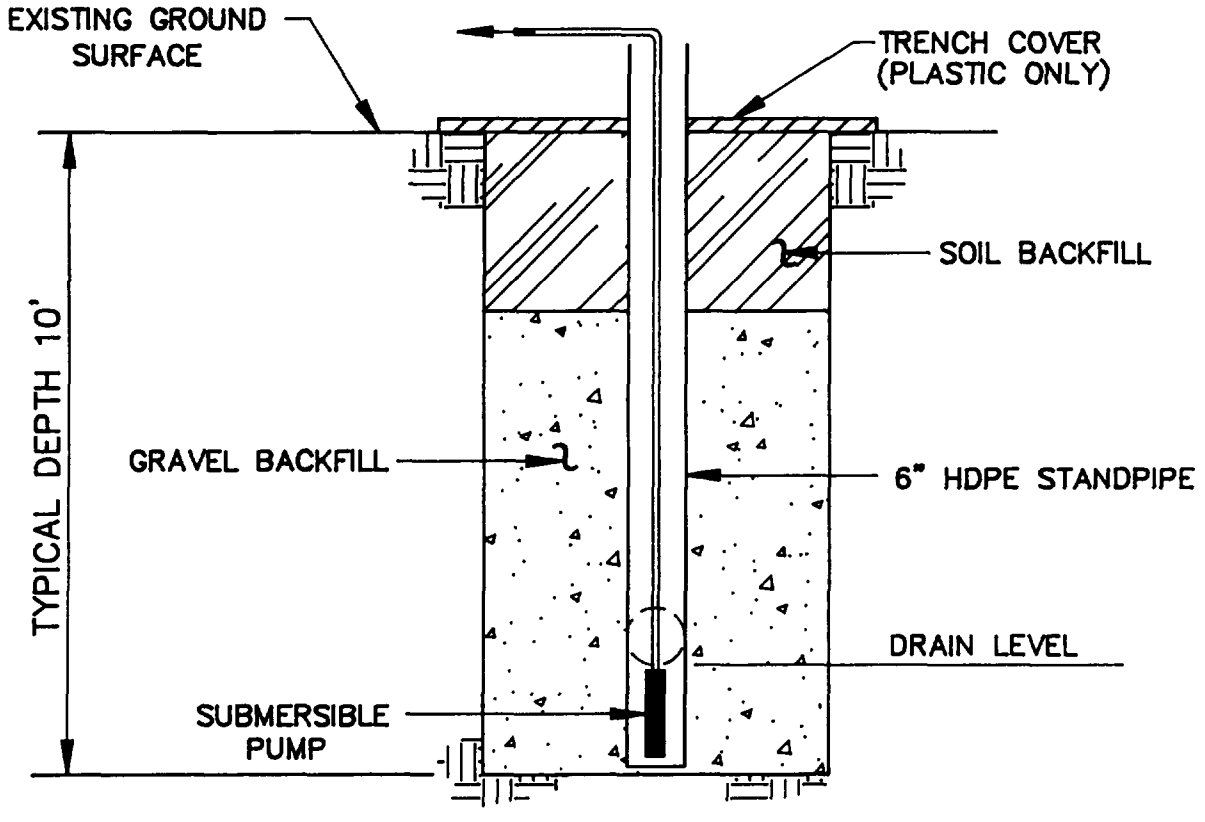

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AWD TECHNOLOGIES, INC

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CLIENT: ENVIRONMENTAL CONSERVATION & CHEMIAL CORP. TRUST | JOB NUMBER: 2259-820

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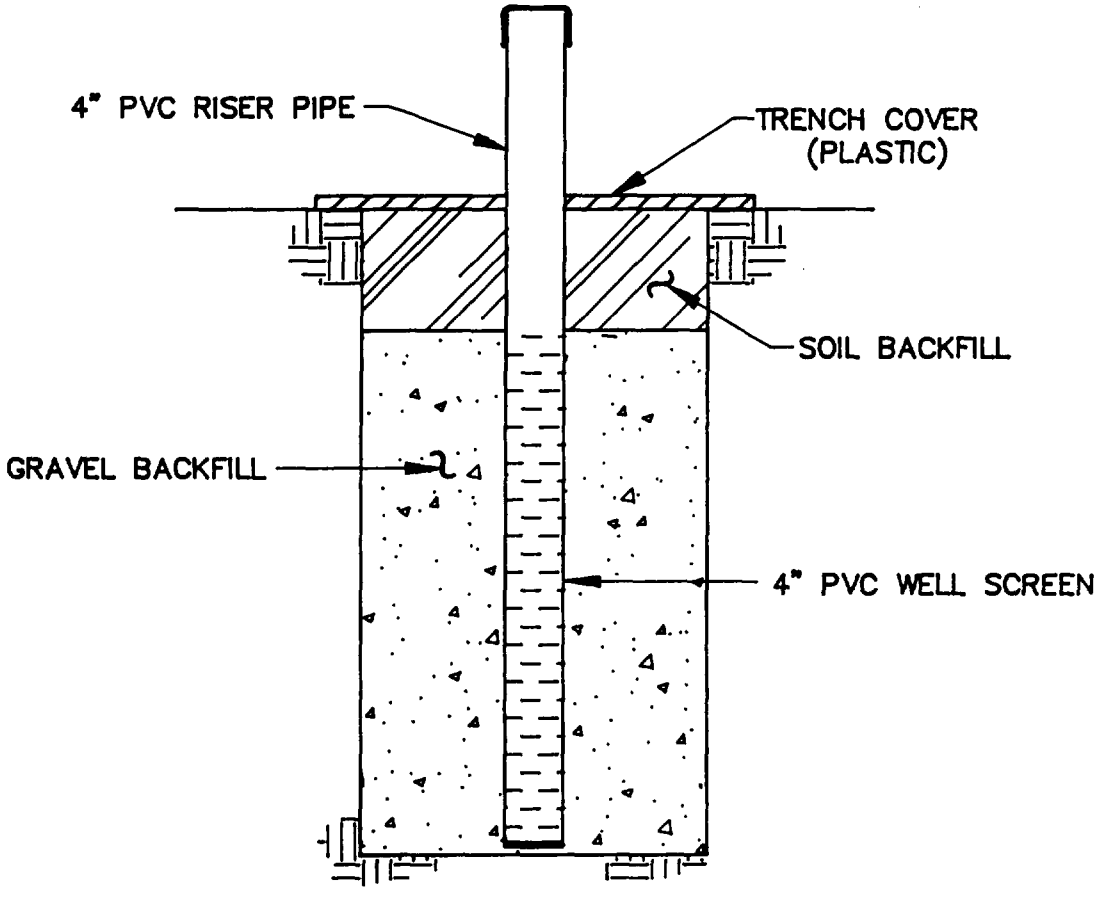

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DEWATERING TRENCH PIEZOMETER TYPICAL DETAIL

ECC SUPERFUND SITE — ZIONSVILLE, IN

DATE: ENVIRONMENTAL CONSERVATION & CHEMIAL CORP. TRUST | JOB NUMBER: 2259-820

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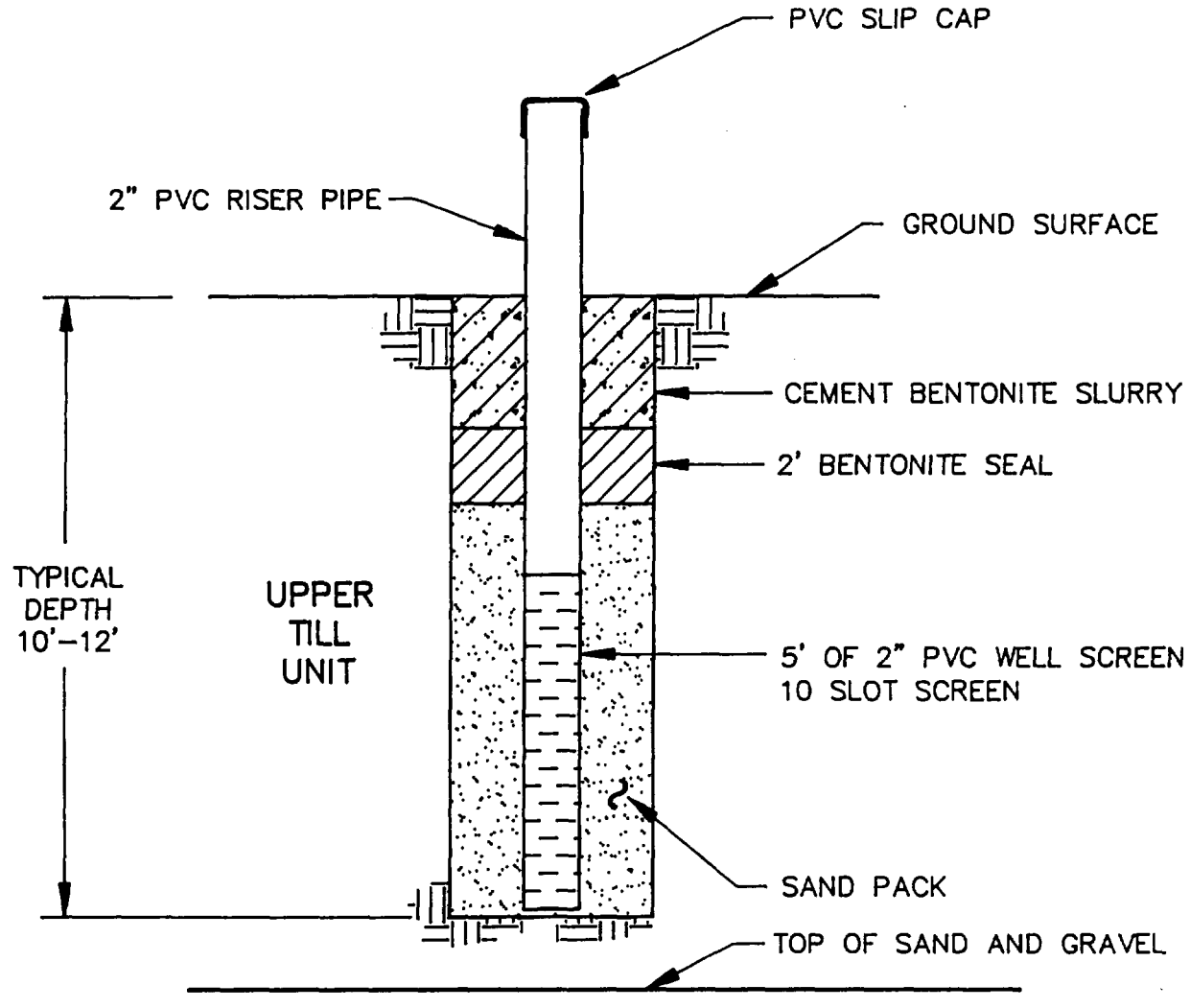

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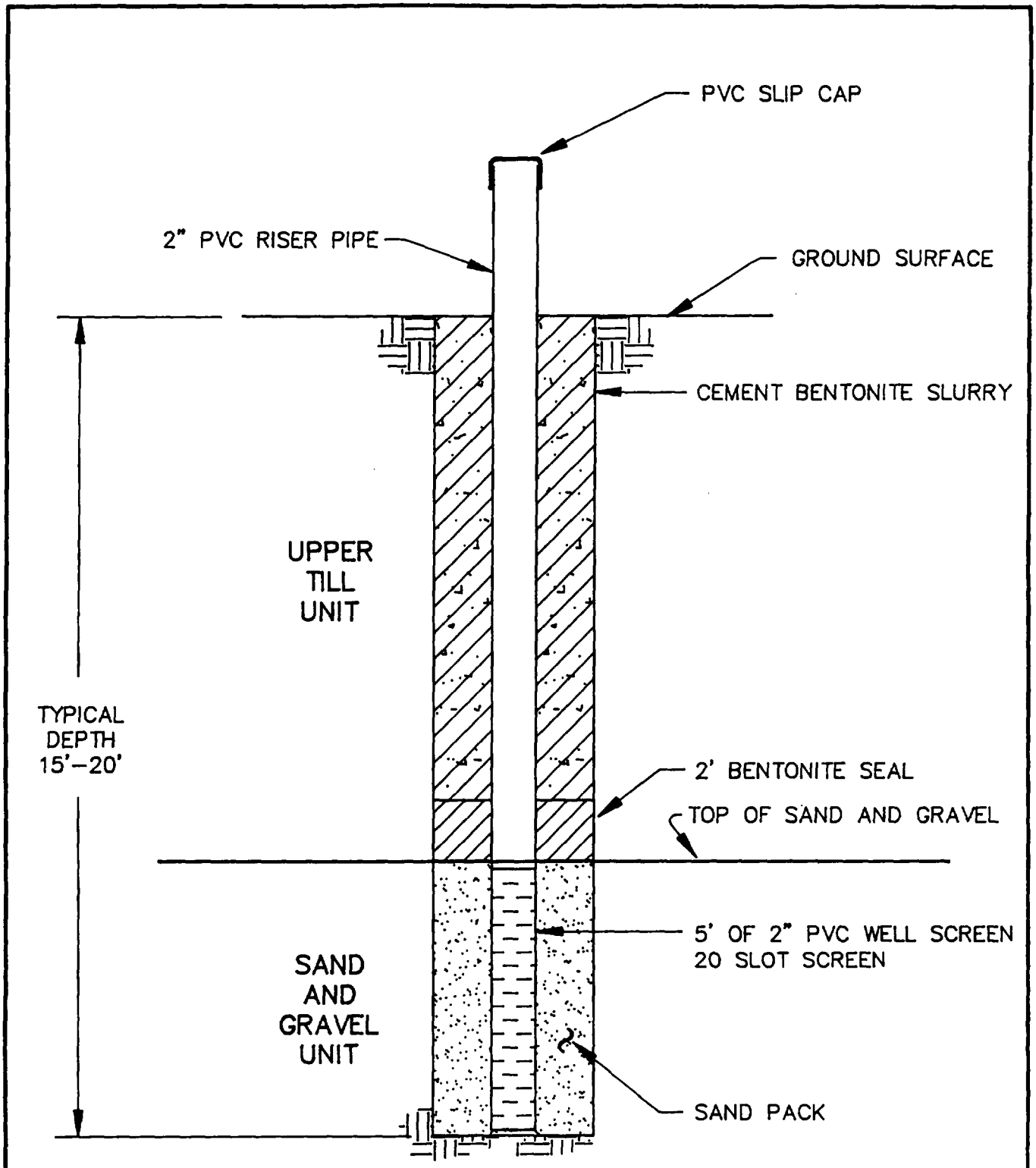

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SAND AND GRAVEL UNIT OBSERVATION PIEZOMETER TYPICAL DETAIL

ECC SUPERFUND SITE — ZIONSVILLE, IN

DATE: ENVIRONMENTAL CONSERVATION & CHEMIAL CORP. TRUST | JOB NUMBER: 2259–820

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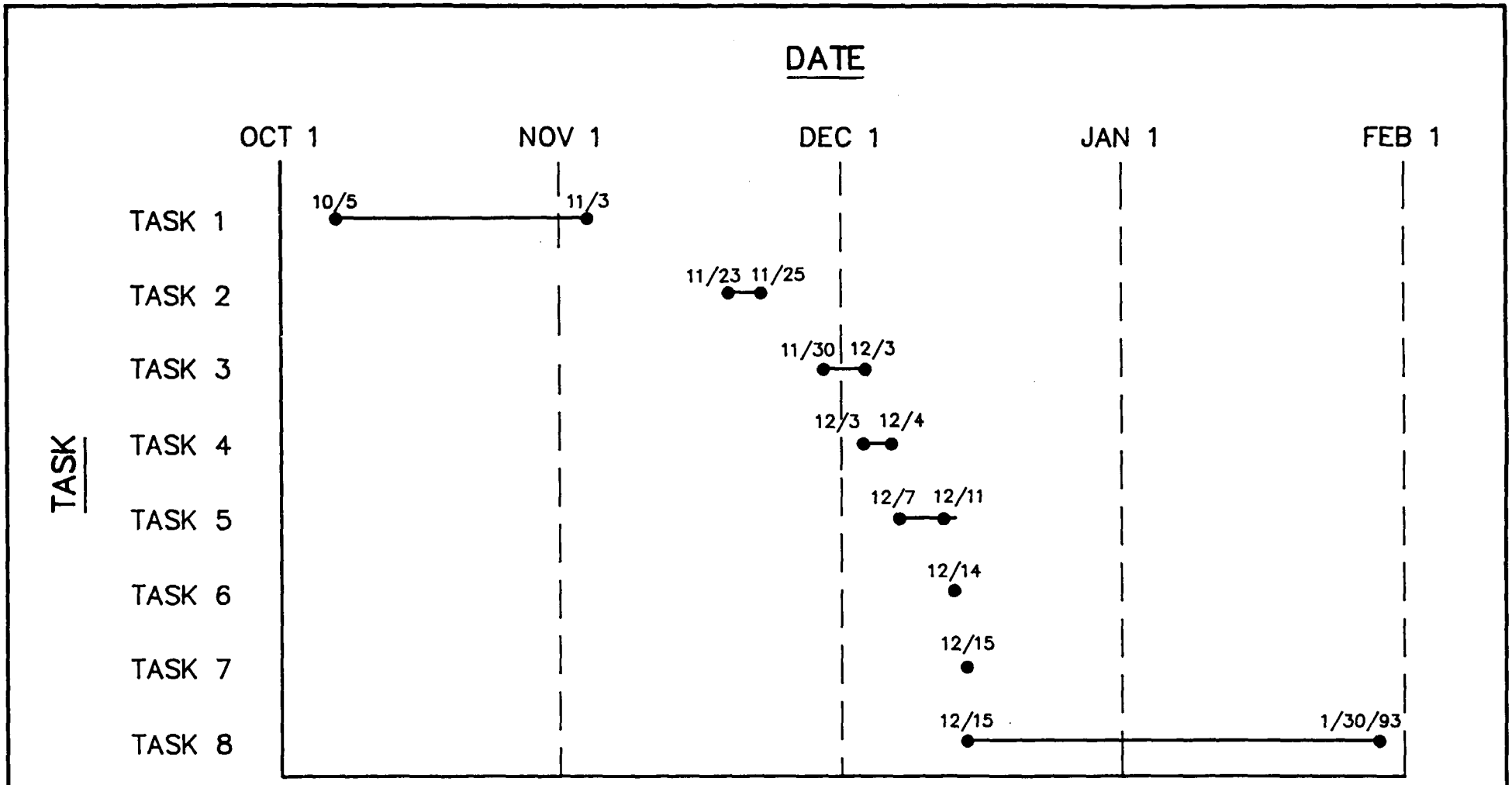

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PHASE II
SUPPLEMENTAL INVESTIGATION SCHEDULE
ECC SUPERFUND SITE ZIONSVILLE, IN

CLIENT: ENVIRONMENTAL CONSERVATION & CHEMICAL CORP. TRUST | JOB NO. 2259-820

SCALE: NONE | FIGURE NUMBER 6 | REV 0

APPENDIX A

TABLE 3-1
SITE-SPECIFIC ACCEPTABLE CONCENTRATIONS

TABLE 3-1 (Page 1 of 2)
SITE-SPECIFIC ACCEPTABLE CONCENTRATIONS
ENVIRONMENTAL CONSERVATION AND CHEMICAL CORPORATION (ECC) SITE

Compounds	Acceptable Subsurface Water Concentration (1,2) (ug/l)		Acceptable Stream Concentration (3,4) (ug/l)	Acceptable Soil Concentration (5,6) (ug/kg)
VOLATILE ORGANICS (VOCs):				
Acetone	3,500	RB		490
Chlorobenzene	60	MCLGP		10,100
Chloroform	100	MCL	15.7	2,300
1,1-Dichloroethane	0.38	RB		5.7
1,1-Dichloroethene	7	MCL	1.85	120
Ethylbenzene	680	MCLGP	3,280	234,000
Methylene Chloride	4.7	RB	15.7	20
Methyl Ethyl Ketone	170	LDWHA		75
Methyl Isobutyl Ketone	1,750	RB		8,900
Tetrachloroethene	0.69	RB	8.85	130
Toluene	2,000	MCLGP	3,400	238,000
1,1,1-Trichloroethane	200	MCL	5,280	7,200
1,1,2-Trichloroethane	0.61	RB	41.8	22
Trichloroethene	5	MCL	80.7	240
Total Xylenes	440	MCLGP		195,000
BASE NEUTRAL/ACID ORGANICS:				
Bis(2-ethylhexyl)phthalate	2.5	RB	50,000	
Di-n-Butyl Phthalate	3,500	RB	154,000	
Diethyl Phthalate	28,000	RB	52,100	
Isophorone	8.5	RB		
Naphthalene	14,000	RB	620	
Phenol	1,400	RB	570	9,800
INORGANICS:				
Antimony	14	RB		
Arsenic	50	MCL	0.0175	
Barium	1,000	MCL		
Beryllium	175	RB		
Cadmium	10	MCL		
Chromium VI	50	MCL	11	
Lead	50	MCL	10	
Manganese	7,000	RB		
Nickel	150	LDWHA	100	
Silver	50	MCL		
Tin	21,000	RB		
Vanadium	245	RB		
Zinc	7,000	RB	47	
Cyanide	154	LDWHA	5.2	
PESTICIDES/PCBs:				
PCBs	0.0045	RB (7)	0.000079 (7,8)	

TABLE 3-1 (Page 2 of 2)
SITE-SPECIFIC ACCEPTABLE CONCENTRATIONS
ENVIRONMENTAL CONSERVATION AND CHEMICAL CORPORATION (ECC SITE)

NOTES:

(1) RB = Risk-based standard. U.S. EPA, Draft RCRA Facility Investigation Guidance, 1987.
MCL = Drinking water Maximum Contaminant Level. 40 CFR 141
MCLGP = Drinking water MCL goal, proposed. U. S. EPA Superfund Public Health Evaluation Manual, update of November 16, 1987.
LDWHA = Lifetime drinking water health advisory. U.S. EPA, Superfund Public Health Evaluation Manual, update of November 16, 1987.

(2) In the event that higher concentrations than those set forth for any parameter in this column are present in the upgradient subsurface water in the till and/or sand and gravel according to the procedure specified below, then those higher upgradient subsurface water concentrations and not the values set forth in this table shall constitute the Acceptable Subsurface Water Concentrations within the meaning of this Exhibit A and the Consent Decree. Those upgradient subsurface water concentrations are referred to in this Exhibit A as "Applicable Subsurface Water Background Concentrations." Twelve subsurface water samples will be taken from existing or new well locations, approved by EPA, over at least a 12 month period in areas upgradient of the site. The exact procedure, location of wells, and schedule for collecting and analyzing the samples will be approved by EPA, after consultation with the State, prior to its implementation. Subsurface samples for inorganics and PCB analysis will be filtered. For each parameter, the analytical results from the 12 samples will be analyzed using standard statistical procedures. The mean and standard deviation will be calculated, and all non-detects will be assigned a value equal to 1/2 the EPA-approved quantification limit. For purposes of this Document, "Applicable Subsurface Water Background Concentrations" is defined as two (2) standard deviations above the calculated mean of these 12 samples.

(3) Stream Criteria, from Table 1 of the Record of Decision for the site, September 25, 1987.

(4) In the event that higher concentrations than those set forth for any parameter in this column are present in the upstream surface water, then those higher upstream concentrations and not the values set forth in this table shall constitute the Acceptable Stream Concentrations within the meaning of this Exhibit A and the Consent Decree. Those higher upstream surface water concentrations are referred to in this Exhibit A as

APPENDIX B

DRILLING, SAMPLING, AND WELL INSTALLATION STANDARD OPERATING PROCEDURES

Objective

This procedure describes in basic terms the principle and applicability of the most common drilling methods utilized for investigative or remedial purposes. The methods described include solid stem and hollow stem augering, drive casing, mud rotary, wash rotary, and air rotary. Rotary rock coring is described in a separate SOP. Soil and rock sample acquisition and classification are also described in related SOPs.

The selection of a drilling method for a given project will be dependent upon many factors including:

- Type of formation or lithology to be penetrated
- Diameter of well screen and casing (if applicable)
- Complexity of hydrogeologic conditions
- The need for representative samples
- Time constraints
- Cost factors

Each method described has advantages and disadvantages for any given drilling situation. A description of each method is given after general procedures applicable to all drilling situations are discussed.

Methodology

General Procedures

Certain procedures are standard to almost all drilling situations. These include formation logging, water level observation, borehole depth measurements, seating casing, and recordkeeping. The specific type of drilling method will alter the exact implementation of these procedures, although the objective in all cases is the same.

Formation logging from samples and/or cuttings should be conducted whenever a description of subsurface geologic conditions is required. In rare instances, it may not be necessary to collect geologic information when drilling a boring for a specific purpose such as obtaining an analytical sample at a specified depth when adjacent wells or test borings are nearby.

Logging of drill cuttings for most drilling operations should be conducted at no less than an interval of once every 5 feet. The characteristics to note include: change in lithology, color, grain size, degree of moisture, odor, and any secondary features such as ironstaining or partings. Where applicable, the cuttings should be scanned with an organic vapor meter to determine the presence of gross volatile organic constituents. Logging of cuttings is applicable for all rotary (except coring) and auger drilling. If mud or wash rotary is utilized, it will be necessary to collect the cuttings from the fluid return by use of a small filter or straining device.

Accordingly, whenever subsurface soil samples such as split spoon samples are collected, they are generally taken at intervals not less than every 5 feet. A description of proper soil classification of these samples is included in the SOP, Field Classification of Soil and Rocks.

Water level observations during borehole advancement are very important when defining the hydrogeologic conditions occurring in a given area. This procedure is generally not applicable to mud rotary drilling since the borehole walls are coated with a mud mixture that reduces greatly groundwater inflow. Proper observation will help define the number of waterbearing zones encountered, saturated thickness, proper screening interval, and whether an aquifer is confined or unconfined. For most drilling observations, water level measurements should be taken frequently. At a minimum, measurements should be taken once every 20 feet of advancement and always before and after scheduled breaks such as lunch and prior to the start and completion of the day's work. Consideration must be given to the dynamic nature of the drilling operation when recording water level data. Where accurate water level readings are necessary, standby time should be allotted so that static water levels can be determined. This is particularly important when adding water to the borehole during the drilling process.

Borehole depth measurements are necessary to accurately log subsurface geology, determine proper termination of borehole, and screen appropriate interval (where applicable). Measurements can be made at any point of borehole advancement by informing the drill operator of your intent. These can be made with a calibrated weighted tape that is lowered to the base of the borehole and measured from ground surface. Generally drill cuttings and caved material will fill the lower few feet of the borehole, particularly if well development has not occurred.

It is also possible to determine with accuracy the depth of any borehole by paying close attention to the total length of the drill string and subtracting that portion of the string still above ground surface. The drill string consists of the drill bit, stabilizers, and all drill rods used to advance the borehole. Careful measurement of each of these items prior to drilling will enable depth determination by knowing the number of rods in the borehole, adding that to the length of the drill bit and stabilizer and then subtracting the amount of the string occurring above ground surface. This procedure is applicable for all drilling situations including augering.

In many drilling situations, it is necessary to set casing into a low permeability layer prior to continued advancement to deeper depths. This procedure is done when it is necessary to:

- Prevent contamination from an upper interval from migrating to a lower interval.
- Prevent cross connection of waterbearing zones.
- Simplify defining site hydrogeologic conditions.
- Isolate a specific interval for sampling or data acquisition.

To set casing, it is first necessary to identify a proper unit that the casing can be keyed into. Ideally, the unit should be fine grained and free of significant fracturing. Upon encountering this unit the borehole should be cleaned out to remove, to the extent practicable, drill cuttings from its base. A depth measurement should then be made to ensure that the hole is open to the proper unit. Casing can then be placed in the hole to the base of the borehole. A bentonite pellet seal is sometimes placed at the base of the boring to reduce the potential for leakage around the casing prior to it being seated. If the casing is designed to be permanent, the entire annulus between the casing and borehole wall is usually sealed with a cement bentonite grout (see SOP 18 Monitoring Well Grouting Techniques).

The casing is seated with the aid of the drill rig down pressure or by ramming it in place with a heavy weight or percussion hammer. Once seated, the inside of the casing is cleaned out with a smaller diameter bit. Drilling can then resume by drilling below the base of the casing with a smaller diameter bit. If the casing has been grouted in place, sufficient time must be allotted to allow the grout to cure prior to advancing the borehole.

Proper recordkeeping is also necessary during all drilling operations. This shall include a record of all drilling operations describing start and finish time of all activities throughout the day. All materials utilized shall also be identified in a daily log. In addition, the following items shall also be included:

- Name and location of job
- Weather conditions
- Boring number and project number
- Surface elevation, approximate or actual
- Boring location
- Boring start and complete date
- Well installation details (if applicable)
- Rig type
- Operator and helper's names
- Borehole diameter
- Casing diameter and depth
- Sample data
- Logging data
- Groundwater observation data
- Drilling problems or unusual conditions
- Hourly work progress

Specific Drilling Procedures

Hollow Stem Augering

Auger drilling is the most common method utilized for environmental or hazardous waste site drilling. It is utilized for advancement through unconsolidated material and, in some instances, weathered bedrock. Hollow stem augers allow for sampling through the inside of the augers thus eliminating the need to pull the drill string each time a sample is required. Well installation can also be accomplished through the inside of the hollow stem augers. This feature is a major advantage to this method as borehole caving concerns are virtually eliminated during well construction.

Hollow stem augering is utilized commonly for shallow drilling of 50 foot depth or less. It is also frequently utilized for deeper penetration but rarely more than a depth of 150 feet. Penetration depth is controlled by subsurface conditions, drill rig torque and thrust, and diameter of the augers. Where the auger string penetrates into a thick water producing zone, significant hydrostatic pressures may be encountered which cause an accumulation of aquifer material (sand or gravel) within the base of the augers because of the pressure differential occurring between the inside and outside of the augers. In this instance,

water is commonly added inside the augers to reduce the pressure differential.

The augering method is advanced by the thrust and rotation of a rotary drill rig being transferred to the auger drill string. Auger flights are added (most commonly in 5 foot lengths) as drilling progresses. The lead auger is fitted with a cutting head consisting of carbide cutter blades that initiate penetration during drilling advancement.

A center plug is commonly installed inside the hollow stem auger to minimize drill cuttings entering the base of the augers. The center plug has an attached bit that helps rotate the augers. The plug is connected to small diameter drill rods that are attached to the rotary drive unit to insure the plug rotates with the augers.

Cuttings during the drilling process are brought to the surface on the outside of the augers by the rotating action of the augers.

The hollow stem auger method is particularly suitable for obtaining accurate soil samples. To facilitate sampling, the auger plug and small diameter drill rods are pulled from the hole. An appropriate sampling device (commonly a split barrel sampler or Shelby tube) is then inserted on small diameter rods to the base of the borehole where a sample is obtained of the underlying formation. Sampling activities are described in the related SOP, Subsurface Soil Sampling.

In addition, well installation procedures can also be conducted inside the augers after the plug is removed. The well casing and screen are inserted to the desired depth inside the augers. The well filter pack is then slowly added inside the augers as the augers are simultaneously removed from the borehole. A complete discussion of this procedure is included in the SOP, Monitoring Well Construction Procedures.

In summary, the major advantages to the hollow stem augering method include:

- Drill rigs relatively mobile and common.
- Reasonable cost-effectiveness.
- Accurate samples can be obtained at any depth without pulling augers.

- Drilling fluids not required.
- Good method for small diameter monitoring well installation.

The major disadvantages to this method include:

- Augering limited to unconsolidated materials.
- Large diameter (6 inch or greater) well installation not practical.
- The effective depth for drilling is frequently 150 feet or less, depending on site conditions, rig, and size of augers.
- In fine grained aquifers, the augering rotation can smear borehole walls which reduce well yield and create severe turbidity within the formation.
- Drill cuttings can become messy and homogenized when saturated conditions are encountered.
- Not recommended for recovery well installation because of the potential for reduced well efficiency.

Solid Stem Augers

The solid stem auger method operates in the same manner as hollow stem augers, however, their practical application is severely limited because they must be pulled from the borehole to conduct sampling or to facilitate well construction. Often, this permits the borehole to cave in unless drilling is conducted in cohesive soils. This method is ineffective drilling loose soils or beneath the water table.

The solid stem auger method is rarely used for waste site activities with its most practical application being shallow boring for soil sampling.

Driven-Case Method

The driven-case method consists of alternately driving casing into the ground and cleaning out the casing, using a rotary bit and air or water to flush out the materials. This method is used in unconsolidated formations only. When the boring is to be used for later well installation, the driven casing used should be least

4 inches larger in diameter than the well casing to be installed. Advantages to this method of drilling include:

- Excellent for defining site hydrogeologic conditions
- Sampling can be conducted while drilling
- Well installation is easily accomplished
- Well development procedures are minimal
- Drill rigs used are relatively small and mobile

Some of the disadvantages include:

- Use is restricted to unconsolidated formations
- Relatively slow advancement
- Depth of borehole varies with the size of drill rig and casing diameter used and the nature of the formations penetrated

Air Rotary Method

Air rotary drilling is conducted using a rotary drill rig that utilizes an air source to cool the drill bit and remove cuttings. To provide the necessary supply of air, the drill rig is supplemented with an air compressor. Compressor size is dependent upon such factors as borehole diameter, drilling depth, and amount of water encountered during drilling. Borehole diameter using air rotary drilling ranges from 4 inches to several feet. The most common diameters utilized for environmental projects range from 6 to 12 inches. Air rotary drilling is principally used for penetration through bedrock but can also be used for advancement through unconsolidated material under favorable conditions. When drilling into bedrock, the borehole is always cased through unconsolidated material to prevent caving.

Any rotary type drill is capable of using this method. Accordingly, drill rig size varies widely depending upon the drilling task. Geotechnical drill rigs that conduct hollow stem augering are increasingly outfitted to do small diameter air rotary work. Air rotary drilling can be conducted using either top head drive hydraulic feed or table drive rotary rigs.

The air rotary operation consists of using one of two bit types attached to a drill string. The compressed air is blown inside the drill string and out of the drill bit. Formation cuttings are subsequently blown out of the hole by the force of the air. When large cavities, fractures, or voids are encountered, air circulation is sometimes lost which prevents the effective removal of cuttings from the borehole.

Generally, the borehole must be cased through the fracture or opening for drilling to continue when circulation is lost.

The two types of bits used for air drilling consist of the roller bit and down the hole hammer. The roller bit exerts a crushing and chipping action on the formation with either hardened steel teeth or tungsten carbide inserts which can be of varied shape, spacing, and design. The teeth are contained on conically shaped rollers on spindles and bearings which turn as the drill string is rotated. The most common bit employs three such rollers thus it is called a tricone roller bit.

The down the hole hammer method employs a pneumatic type drill operated at the end of the drill string that rapidly strikes the rock while the drill rods are slowly rotated. This effect is similar to the blows delivered by a cable tool rig. The bit part of the hammer is constructed of tungsten-carbide inserts or carbide buttons. The down the hole hammer is primarily used for drilling extremely resistent rock types such as basalt, quartzite, and granite.

A major advantage of the air rotary method is that bit size is readily interchangeable simply by tripping the drill rods out of the borehole and changing the bit. This becomes necessary when casing is required within a portion of the borehole. Two or three different sizes of casing sealed at different depths are possible in a borehole when complex subsurface conditions are encountered. Drill casing installed in the borehole can be set by a variety of methods including ramming, driving, or spinning. Various types of tools or machinery are available to assist in this process. Once set, the casing is always cleaned out using a smaller diameter drill bit.

Other advantages to the air rotary method include:

- Excellent method for advancement into deep waterbearing zones. Casing can be set and sealed at the base of shallower waterbearing zones which eliminates cross connection between aquifers.
- The dry drilling method, if properly supervised, yields accurate information regarding water producing zones, well yield, and water level depth.
- Drilling fluids are not introduced into the aquifer.

- Large diameter wells are possible.
- Drilling rate of penetration generally high.

The major disadvantages include:

- Samples are limited to drill cuttings.
- Drilling through loose unconsolidated material can be difficult to impossible, particularly if boulders are present.
- Water inflow into wells can be masked by use of air pressure.
- Capital costs and maintenance of air compressors are high.
- If used to penetrate through contaminated horizons, vapors may be quickly brought to the surface by the compressed air circulation.

Mud Rotary

Mud rotary drilling is achieved by rotating a drill bit attached to a drill string under a downward force that is applied by the drilling rig. The drilling fluid consists of bentonite and in many cases organic polymers that are introduced into the borehole as drilling progress to stabilize the borehole walls and remove drill cuttings. In the direct rotary method, the drilling fluid is pumped into the borehole through the inside of the drill pipes and out through the bit which then flows upward and out of the borehole carrying the cuttings produced by the drilling operation.

This method is applicable for drilling both in unconsolidated material and bedrock, however its principal use is to penetrate caving unconsolidated material or where loss of drilling circulation is a problem (such as severely fractured or cavernous rock). Borehole diameter generally ranges from 5 to more than 20 inches with 6 to 12 inch diameter boreholes common for environmental drilling. Drilling depth using this method can be achieved for several thousand feet.

Various drill bits can be used during mud rotary drilling depending upon the formation being penetrated with the most common being a roller bit or a drag bit. Drag bits have short blades each forged to a cutting edge and faced with durable metal. Nozzles release

drilling fluids down the face of the blades to clean and cool them. Drag bits penetrate by a shearing action and work rapidly in sands, clays, and soft rock but are not as effective in coarse gravel and hard rock formations.

Roller bits are principally used to penetrate hard rock formations and are described under the air rotary method of drilling.

To be effective, the mud rotary operation must continually circulate drilling fluids and remove drill cuttings. The drill fluids are contained in a pit or mud tub at the ground surface and recirculated back into the borehole after the cuttings have settled out. Logging of cuttings is achieved by straining the mud fluid as it emanates from the borehole and collecting the cuttings present. Frequently, the cuttings must be washed with clean water for proper identification and logging. In some drilling operations, subsurface soil samples are obtained via Shelby tube sampler or split spoon. This is best utilized for specific intervals and not for frequent sampling since the sampling exercise interrupts the continuity of this drilling method. Careful attention should also be given, as in all types of drilling, to penetration rate and drill bit noise as variations in these can be good indicators of a change in formation.

Mud rotary drilling in environmental projects is most applicable to well installation in unconsolidated materials, particularly in high yield formations or at deep depths. It is also effective for installing large diameter wells. Because the encountered waterbearing zones are effectively "shut off" from the borehole by the mud filtrate that stabilizes the borehole walls, mud rotary drilling is a poor exploratory method and is best used when hydrogeologic conditions are fully defined.

An alternative use for mud rotary drilling is to provide penetration in areas where hazardous vapors are anticipated such as through or into a landfill. The mud cake on the borehole walls will reduce or prevent the liberation of vapors or gases encountered during drilling advancement.

In summary, the advantages of mud rotary drilling include:

- Good method for well installation in high yielding unconsolidated material and deeper aquifers.
- Good for large diameter (6 inch or greater) well installation.

- Uncased borehole can be logged by borehole geophysics even in unconsolidated material.
- Can prevent loss of circulation in some fractured media.
- Relatively common and inexpensive.

The disadvantages of this method include:

- Frequent subsurface soil sampling not practical.
- Poor exploratory tool with regard to hydrogeologic conditions.
- Well yield can be affected by residual mudcake.
- Development can be time consuming and difficult.
- Water quality in some cases can be altered by polymer additives.

Wash Rotary Methods

Wash rotary methods are similar in principal to mud rotary except that water is used as a drilling medium in lieu of a mud mixture. This method is more commonly used when advancing a borehole in consolidated material than in unconsolidated material. It cannot be used in situations where caving of the formation is a problem (saturated alluvial deposits, gravel).

In environmental work, the wash rotary method is utilized primarily for well installation procedures in bedrock. It is not a good exploratory method since the addition of water complicates definition of hydrogeologic conditions. When subsurface samples are required, rotary rock coring can readily be conducted at comparable cost and at a generally faster rate.

The main advantages to the wash rotary method are:

- Applicable to a large variability in borehole diameter
- Requires generally easy well development procedures
- Inexpensive and common

The major disadvantages include:

- Limited applicability in unconsolidated material
- Logging limited to borehole cuttings
- Usually slower than coring in bedrock

Reverse Circulation Rotary Method

The reverse circulation rotary method is similar to the direct rotary method except that the circulation of drilling fluid is reversed. Drilling fluid enters through the borehole annulus and is pumped out of the inside of the drill pipe. Drill cuttings are removed from the borehole by the water discharged from the drill pipe. The application of this method is primarily for drilling of very large (24 inch or greater) diameter boreholes for production water wells in soft consolidated rocks and unconsolidated material. Its application to environmental projects is limited except perhaps for installation of high yield recovery wells under the appropriate subsurface conditions. Because of its limited applicability, this method will not be discussed further.

References

For further information, the reader should refer to the following:

Driscoll, Fletcher, Groundwater and Wells, Johnson Division, St. Paul, Minnesota, 1986.

W. L. Acker III, Acker Drilling Company, Scranton, Pennsylvania, 1974. Acker, W. L., III Basic Procedures for Soil Sampling and Core Drilling

Scope

Soil sampling is an important component of a hydrogeologic investigation. Vadose zone sample analysis may indicate the presence of contaminants which have not reached the water table, but have the potential for future contamination of the groundwater. Soil type can typically vary across a study site and affect groundwater conditions. Therefore, it is important to maintain an accurate field record during sampling operations. Engineering and physical properties of soil may also be of interest should site construction activities be planned. The physical characteristics of soil which are of interest include: soil type, bearing strength, compressibility, permeability, plasticity, and moisture content. Relative density, compactness, and cohesiveness of soils is determined by the Standard Penetration Test described in this text.

The objective of this section is to provide the methods and sequence of operations for subsurface soil sampling. The methods utilized are ASTM D1586-67, Method for Penetration Test and Split Barrel Sampling of Soils, and ASTM D1587-74, Thin-Walled Tube Sampling of Soils.

Definitions

Undisturbed Sample: A soil sample that has been obtained by methods in which every precaution has been taken to minimize disturbance to the sample.

Water Table: A surface in an aquifer where groundwater pressure is equal to atmospheric pressure.

Equipment

The following equipment usually provided by the drilling subcontractor is needed for subsurface soil sampling operations:

- Drilling rig/equipment.
- Split barrel (split spoon) samplers, OD 2 inches; ID 1 3/8 inches; length 27 inches (open).
- Thin-walled tubes (Shelby), OD 2 to 5 inches; length 36 to 54 inches.

- Drive weight assembly, 140 lb weight, driving head and guide permitting 30 inch free fall.

- Sampling equipment including: labels, paraffin, stove, and sample jars (glass, 3 1/2 inch high, 2 inch ID), etc.

It is the site hydrogeologist's responsibility to ensure that all appropriate equipment is onsite prior to initiation of operations.

Prior to initiating either sampling method, the following will apply:

- The hole will be advanced to the desired sampling depth using equipment that will ensure that the interval to be sampled is not disturbed.

- Bottom discharge drill bits are not permitted, although side discharge drill bits may be utilized.

- Jetting through an open-tube sampler during advance and then sampling at the desired depth is not permitted.

- Casing shall not be advanced below the sampling elevation.

Split Spoon Samplers

Split-spoon samplers consist of a heavy steel sampling tube which can be split into equal halves to reveal the soil sample. A drive head is threaded to the upper end, which in turn in threaded on the drill rod. A tapered nosepiece is threaded to the other end and facilitates advancement. A sample retainer may be inserted into the nosepiece which prevents the loss of dry soil samples when the sampler is removed. The sampling procedure is as follows:

- Place the split spoon sampler, attached to the drill rod, on the bottom of the drill hole. Using a 140 lb hammer falling 30 inches, drive the sampler either 18 inches or until 100 blows have been reached.

- Record the number of blows required to drive the spoon each 6 inch interval. The first 6 inch interval driven is considered the seating drive. When the spoon is driven the entire 18 inch interval, the sum of the second and third 6 inch interval blow counts is considered the penetration resistance (N). When less than 18 inches is driven, the last 1 foot interval blow count sum is

considered the penetration resistance. If less than 1 foot is penetrated, record the blow count and depth penetrated. This procedure is referred to as the Standard Penetration Test.

- Remove the sampler from the hole and detach from the drill rod. Remove the drive head and nosepiece and separate the split spoons, taking care not to shear or disturb the soil sample. A small portion at the top of the sample is usually disturbed and should be discarded. Place the undisturbed soil into sample jars without compacting the sample. To prevent the evaporation of soil moisture, the jars should be either hermetically sealed or sealed with wax, if soil moisture content is a concern.

- Affix to the jar an adhesive label containing the following information: boring number, sample number, depth penetration record, and length of recovery. The samples should be protected against extreme temperature conditions.

Thin-walled Seamless Tube Samplers

Thin-walled seamless tube samplers (Shelby tubes) are utilized to obtain undisturbed soil samples. Their use is somewhat restricted, depending upon the consistency of the soil to be sampled. Very loose and/or wet samples cannot be obtained by the sampler, and soils with a consistency in excess of medium stiff cannot be penetrated by the sampler. There are devices available to be used in conjunction with the tubes to aid in the recovery of these soils. Should the method prove inadequate in obtaining a sample, a split spoon should be utilized to obtain a sample for classification purposes.

The sampling procedure is as follows:

- Place the sampling tube on the bottom of the drill hole. Apply pressure on the tube, pushing the tube into the soil at a constant rate. Care should be taken not to allow impaction or twisting of the tube. Only allow the tube to penetrate to a depth equal to the length provided for the sample, allowing 3 inches for cuttings and sludge.

- Upon completion of penetration, allow the tube to remain in its position period of 5 to 15 minutes. This will

allow equalization of pressure in the soil and adherence to the walls of the tube.

- Prior to removal of the tube, shear the sample by turning the tube 2 complete revolutions with a pipe wrench.

- Upon removal of the sampler tube, record the sample length and the length penetrated. Remove the disturbed soil in the upper end and record the final length. Remove approximately 1 inch of soil from the lower end. Insert an impervious disk, and seal both ends with wax. Care should be exercised so as not to allow the wax to enter the sample. Place newspaper or other suitable filter in the voids at either end of the sample. Secure plastic caps on both ends, tape them, and seal by dipping both ends in wax.

- Affix to the tube adhesive labels containing the following information: job designation, sample location, boring number, sample number depth, penetration, and recovery length. Using indelible ink, mark the same information on the tube and mark the location of the top of the sample.

- Store tubes upright in a cool place out of the sun. Do not allow the tubes to freeze. Samples should be surrounded with resilient packing material when shipped to reduce shock, vibration, and disturbance.

- A description of the soil removed from both ends of the tube should be recorded in the field log.

Data Collection

The data obtained during the sampling operations is recorded in the field log and should include the following:

- Name and location of site

- Date of boring (start and finish)

- Boring number and coordinate, if available

- Surface elevation, if available

- Sample number and depth interval

- Type and size of sampler
- Method of advancing sampler; penetration and recovery lengths
- Drill rig type
- Soil description
- Layer thicknesses
- Depth to water, to loss of water, and to artesian head, including time of observation
- Casing size, depth of cased hole
- Blow count
- Names of crewmen
- Weather, remarks

APPENDIX C

EXAMPLE CHAIN OF CUSTODY

AWD Technologies, Inc.

CHAIN OF CUSTODY RECORD

PROJECT NO.	PROJECT NAME	PARAMETERS	INDUSTRIAL HYGIENE SAMPLE Y / N
SAMPLERS: *(Signature)*	(Printed)		

FIELD SAMPLE NUMBER	DATE	TIME	COMP.	GRAB	STATION LOCATION	NO. OF CONTAINERS									REMARKS

Relinquished by: *(Signature)*	Date / Time	Received by: *(Signature)*	Relinquished by: *(Signature)*	Date / Time	Received by: *(Signature)*
(Printed)		(Printed)	(Printed)		(Printed)

Relinquished by: *(Signature)*	Date / Time	Received for Laboratory by: *(Signature)*	Date / Time	Remarks
(Printed)		(Printed)		

Distributio iginal Plus One Accompanies Shipment (white and yellow), Copy to Coordinator F Files (pink).

APPENDIX D

PERMEABILITY TEST DATA SHEETS

AWD TECHNOLOGIES

HYDRAULIC CONDUCTIVITY TESTING DATA SHEET

PROJECT NAME:		WELL/BORING NO.:
PROJECT NO.:	GEOLOGIST:	
WELL DIAMETER:	SCREEN LENGTH/ DEPTH:	TEST NO.:
STATIC WATER LEVEL: (DEPTH / ELEVATION)		DATE:
TEST TYPE: (RISING/FALLING/CONSTANT HEAD)		CHECKED:
METHOD OF INDUCING WATER LEVEL CHANGE:		PAGE OF

TIME	ELAPSED TIME (MIN. OR SEC.)	MEASURED DEPTH TO WATER (FEET)	CORRECTION	DEPTH TO WATER (FEET)	DRAWDOWN OR HEAD (FEET)	REMARKS

APPENDIX E

SITE HEALTH AND SAFETY PLAN

SUPPLEMENTAL INVESTIGATION
HEALTH AND SAFETY PLAN
PHASE II

ENVIRO-CHEM SITE
ZIONSVILLE, INDIANA

PREPARED BY:
AWD TECHNOLOGIES, INC.
PITTSBURGH, PENNSYLVANIA

AWD PROJECT NUMBER 2259

DECEMBER 1992

Approval of Health and Safety Plan for the Supplemental Investigation at the Enviro-Chem Site in Zionsville, Indiana.

Corporate Health and Safety Manager
Gary C. Beswick, CIH _____

Project Manager
Bradford K. Grow _____

Project Hydrogeologist
Donald A. Ruggery, Jr. _____

Project Health and Safety Officer
Mark A. Mihalo _____

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APPENDICES

ACRONYMS

Personnel

CHSM	Corporate Health and Safety Manager
HSO	Health and Safety Officer
SSO	Site Safety Officer
PM	Project Manager
SM	Site Manager
TL	Team Leader
CO	Contracting Officer
MC	Medical Consultant

Equipment

PID	Photoionization Detector
LEL/O_2	Lower Explosive Limit/Oxygen
RAD	Radiation Meter

Areas

SZ	Support Zone
CRZ	Contamination Reduction Zone
EZ	Exclusion Zone

Manuals

HSP	Health and Safety Plan
APP	Accident Prevention Plan
AMP	Air Monitoring Plan
SDCP	Spill Discharge and Control Plan

Other

ABIH	American Board of Industrial Hygiene
ACGIH	American Conference of Governmental Industrial Hygienists
ARC	American Red Cross
CFR	Code of Federal Regulations
CIH	Certified Industrial Hygienist
MSDS	Material Safety Data Sheets
NIOSH	National Institute of Occupational Safety and Health
OSHA	Occupational Safety and Health Administration
PPM	Parts Per Million
USCG	United States Coast Guard
U.S. EPA	United States Environmental Protection Agency

PROJECT HEALTH AND SAFETY PLAN

Administrative Information

Project Name: Enviro-Chem Site
Project Number: 2259
Project Location: 865 South, State Route 421, Zionsville, Indiana 46077
Project Manager: Bradford K. Grow
Issue Date: October 1992
Effective Period: November 1992

Project Organization

Name	AWD Employee Function	Responsibilities
Bradford K. Grow	Project Manager	As defined by Corporate Health and Safety Manual
Donald A. Ruggery, Jr.	Field Operations Leader/Geologist	As defined by Corporate Health and Safety Manual
Mark A. Mihalo	Divisional H&S Representative/SSO	As defined by Corporate Health and Safety Manual
Gary C. Beswick	CHSM	As defined by Corporate Health and Safety Manual
TBA	Equipment Operator	As defined by Corporate Health and Safety Manual
TBA	Laborer	As defined by Corporate Health and Safety Manual
TBA	Laborer	As defined by Corporate Health and Safety Manual
	Other	

1.0 SCOPE OF ACTIVITIES

1.1 Project Background Information

Site Status: ___X___ Active _____ Inactive

Physical Features: Enviro-Chem (ECC) is in Boone County, about 10 miles northwest of Indianapolis. The site occupies 6.5 acres alongside the 168-acre Northside Sanitary Landfill (NSL). The ECC facility is bounded on the east by the landfill. An unnamed ditch separates the two facilities along the east boundary. The site is bounded on the north and west sides by several residential homes.

Summary of Previous Site Activities: ECC began operations in August 1977 and was engaged in recovery/reclamation/brokering of primary solvents, oils, and other wastes from industrial clients. Still bottoms and liquid waste from oil recovery were disposed of at the NSL facility. In July 1979, an oil spill into Eagle Creek was reported and inspection revealed origination from ECC and NSL. In November 1979 a water sampling and analysis program which revealed concentrations of metals, oil and grease, and phenols. ECC was designated as a potential hazardous waste site by U.S. EPA in December 1979. Based on violations, the EMB referred matters to the Office of the Attorney General in May 1980.

An ECC employee died of exposure to toxic vapors after entering a solvent tanker in February 1981.

A Consent Decree (July 1981) imposed a civil penalty and the court placed ECC into receivership and prohibited the company from using NSL for disposal giving ECC until November 1982 to comply with environmental regulations. ISBH began monitoring of ECC's drum storage to insure reduction of barrel inventory. The area occupied by drums was found extremely overcrowded and drums were degrading and leaking. A concrete drum storage pad was constructed by October 1981 and drums were reduced to 20,000. This number was reduced to 225 by December 1981. EMB placed a freeze on drum shipments in February 1982. ECC was ordered to close and environmentally secure site for failure to reduce hazardous waste inventories. By August 1982 ECC was found to be insolvent and planning work began for environmental revitalization. In September 1982 the OAG held conference with ISBH and

representatives from 60 potential PRPs to produce a voluntary cleanup plan. Initial negotiations between U.S. EPA and the generators for a site surface cleanup were not successful.

Summary of Previous Investigations/Cleanup Operations: From 1976 through 1982 sampling and testing efforts were conducted. Much of the historical data could not be used as basis for definitive interpretations of existing conditions. The data could be used for qualitative assessments of contamination, and in determining locations in need of additional testing. Information on environmental media is summarized in the remedial investigation report which was performed by CH2M Hill and dated March 14, 1986. A feasibility report was also produced by CH2M Hill and a public comment meeting report was issued and dated December 5, 1986.

In March and April 1983, the U.S. EPA removed and treated approximately 850,000 gallons of water from a cooling water pond to prevent overflows to the unnamed ditch. In November 1983 a Consent Decree was entered in U.S. District Court whereby generator funding was provided for completion of removal activities. This work was substantially completed in August 1984 and consisted of:

- Sampling and fingerprint testing of approximately 30,000 drums.
- Shipment of approximately 20,000 drums to licensed offsite disposal.
- Removal of empty drums.
- Removal and disposal of 282,500 gallons of liquid wastes.
- Excavations and shipment of approximately 5,200 cubic yards of contaminated soil and cooling water pond sludge.
- Removal and shipment offsite to a licensed hazardous waste treatment facility of about 4,500,000 gallons of contaminated cooling pond water.
- Excavation and shipment offsite to a licensed disposal facility of 452 cubic yards of contaminated soils from the polymer solidification pit.

- Pressure washing of the concrete pad (about 27,000 square feet).

- Cleaning of the processing building and equipment.

On August 1, 1984, U.S. EPA approved funding to undertake further surface cleanup work, some of which was reimbursed by the Consent Decree entered in November 1983. The following activities were completed:

- Removal of remaining sludge from the bottom of the cooling water pond and onsite containment.

- Removal of remaining sludge from the bulk storage tanks.

- Cleaning and/or disposal of the bulk tanks.

- Removal of two underground tanks.

- Removal of a leaking PCB-filled transformer.

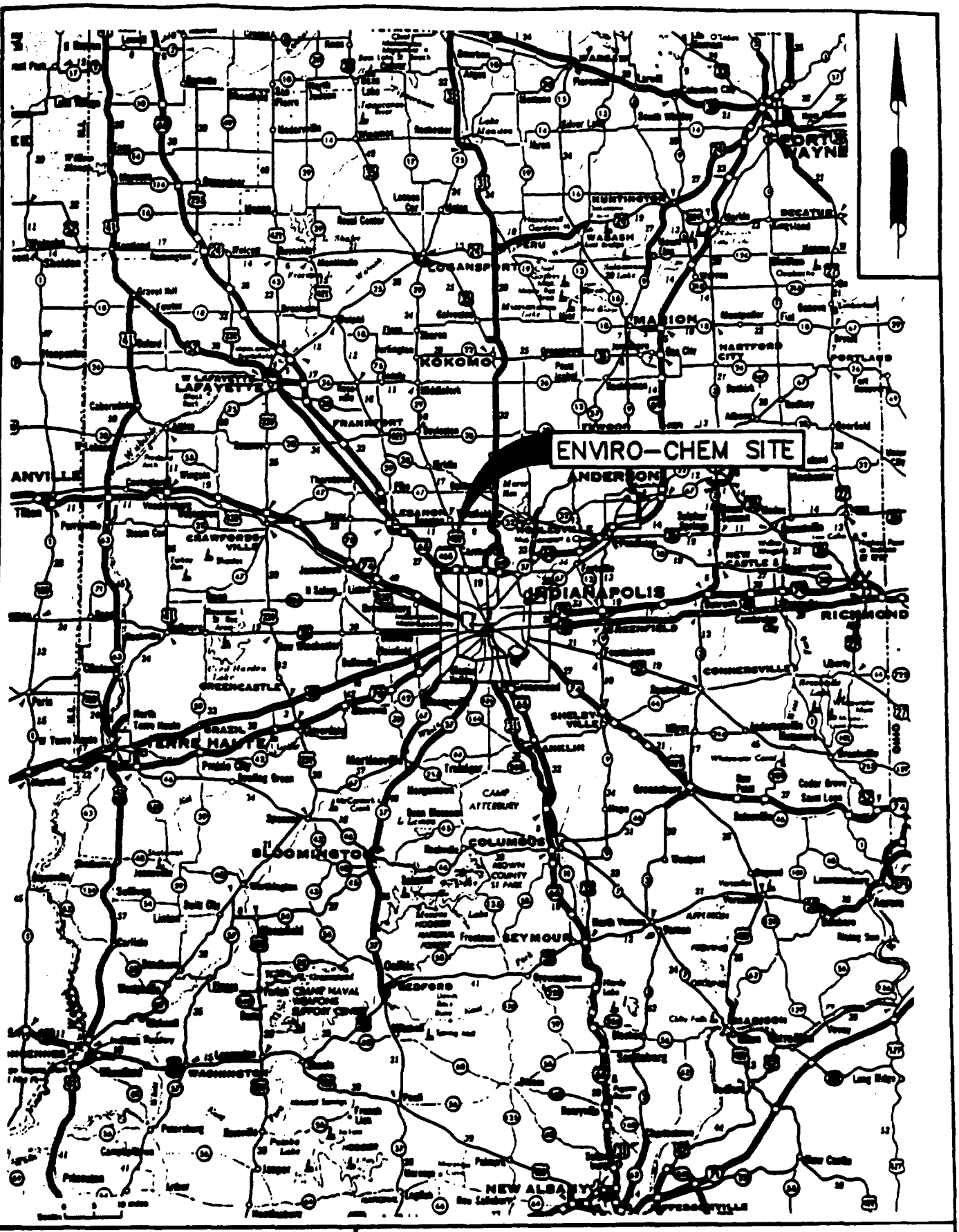
- Removal of miscellaneous piping.

- Placement of a clay cover on the surface of the site, including filling in of the cooling water pond.

1.2 Scope of Work Activities for Phase II Supplemental Remedial Investigation

One pilot scale dewatering trench 50 feet long and 9 to 10 feet deep will be excavated on the north end of the ECC Site. In addition, one test pit 5 feet long and 9 feet deep will be excavated through the concrete pad on the south end of the site. Ultimately, the trench and the test pit will be used to pump groundwater for 72 hours, with the possibility of recovering up to approximately 86,000 gallons of groundwater which will be stored in large onsite storage tanks. The present scope of work for the stored water is to remain onsite until site preparation is performed prior to remedial construction. After completion of hydraulic testing the trenches will then be backfilled to grade.

Four observation piezometer wells will be installed at various points about the ECC Site by an AWD-approved drilling subcontractor. Site layout maps are currently being revised and will be added into this section upon its completion.

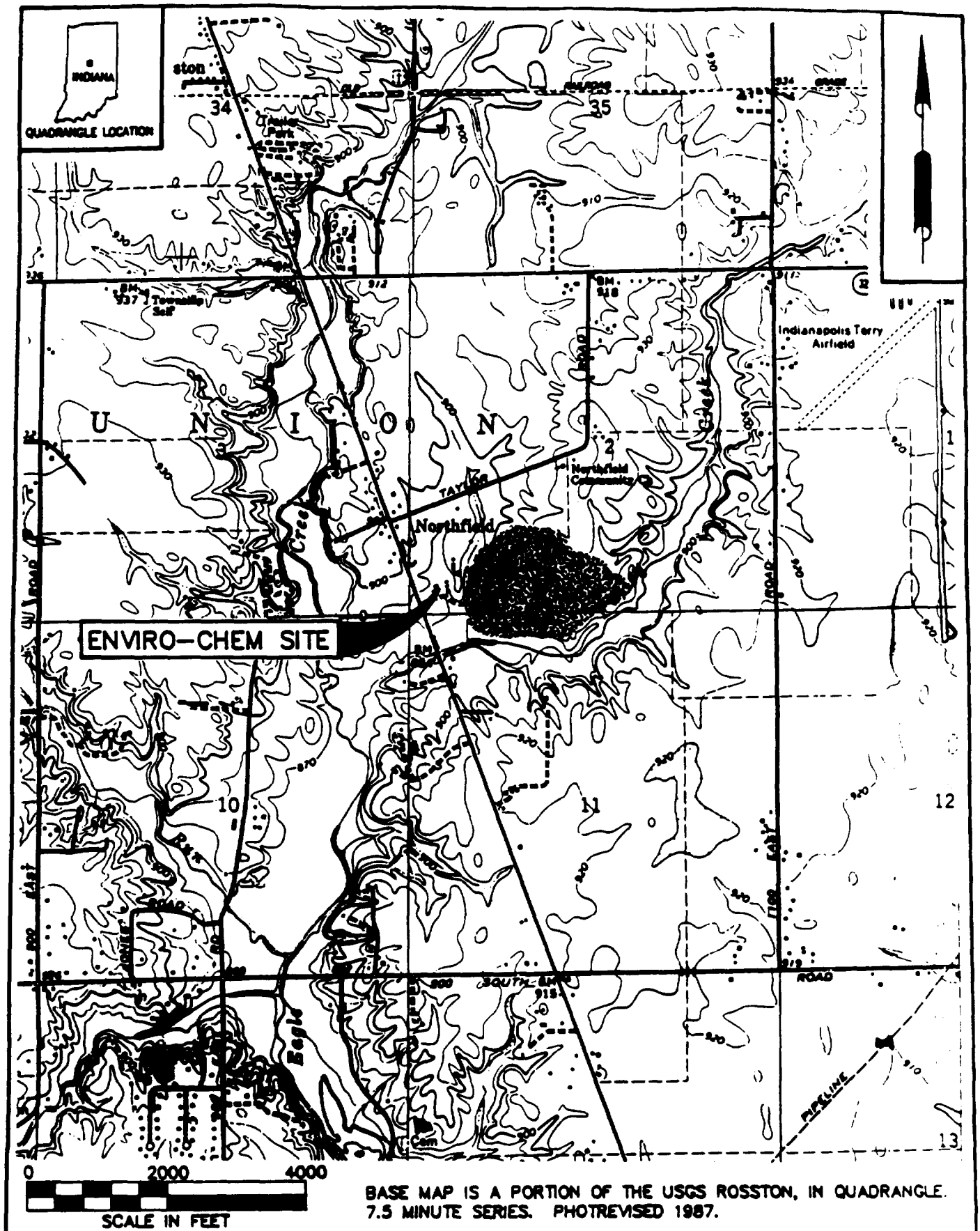


AWD TECHNOLOGIES, INC

AWD TECHNOLOGIES

SITE LOCATION MAP
ENVIRO-CHEM SITE, ZIONSVILLE, IN

SCALE: AS SHOWN	FIGURE NUMBER	REV 0



BASE MAP IS A PORTION OF THE USGS ROSSTON, IN QUADRANGLE. 7.5 MINUTE SERIES. PHOTREVISED 1987.

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AWD TECHNOLOGIES

SITE MAP
ENVIRO-CHEM SITE, ZIONSVILLE, IN

SCALE: AS SHOWN	FIGURE NUMBER	REV 0

2.0 CONTRACTOR ORGANIZATION AND RESPONSIBILITIES

2.1 General

All onsite personnel will be required to comply with the requirements of this HSP. Line management will be responsible for implementing this plan and ensuring that it is enforced. Line management will be assisted in this effort by staff health and safety personnel.

2.2 Responsibilities

The responsibilities of the Site Manager, Corporate Health and Safety Officer, and the Site Safety Officer are as follows.

2.2.1 Site Manager/Field Operations Leader

The Site Manager (SM)/Field Operations Leader (FOL) is the appointed manager of the project. He is responsible for the general oversight of the progress of onsite activities, including the management of all onsite field personnel, and for implementing actions to ensure compliance with the HSP. The SM/FOL is responsible for coordinating and providing the necessary labor and materials for the implementation of the HSP.

2.2.2 Health and Safety Officer

The Health and Safety Officer (HSO) is responsible for the preparation, implementation, and enforcement of the HSP. Specific responsibilities include:

- Conducting the initial site-specific health and safety orientation meeting and providing support for additional meetings as periodically required.

- Providing support for all onsite health and safety activities as needed and shall be responsible for decision-making involving the upgrade or downgrade in personal protective equipment.

- Establishing new health and safety measures as appropriate based on changing conditions.

- Maintaining all related health and safety documentation, including, but not limited to, employee medical qualifications, respirator fit tests, medical surveillance, and field monitoring results.

- Authority to stop work if conditions are deemed unsafe.

- Authority to temporarily remove an individual from the site if he/she is not complying with the HSP protocols.

2.2.3 Site Safety Officer

The Site Safety Officer (SSO) is responsible for providing technical guidance to the Site Manager on matters pertaining to health and safety. The SSO's primary responsibility is to assist the HSO in the implementation and enforcement of the HSP.

Specific duties of the SSO include, but are not limited to:

- Enforcing compliance with the HSP.

- Coordinating and conducting onsite safety briefings for all site personnel.

- Managing health and safety equipment (respirators, instruments, boots, gloves, suits, etc.).

- Coordinating and performing air monitoring with the HSO as specified in the HSP.

- Establishing work/rest regimen in conjunction with the Site Manager (i.e., heat stress/cold stress monitoring).

- Helping establish emergency response provisions with local authorities (e.g., hospital, fire, and police).

- Continuously monitoring health and safety conditions during the implementation of the site work.

- Maintaining site safety field logs to record air monitoring results, weather conditions, employees onsite, safety problems, and other related information.

- Reporting all incidents to the HSO.

- The authority to stop work if conditions are deemed unsafe; also the authority to temporarily remove an individual from the site if he/she is not complying with the HSP. In both cases, the SSO will probably confer with the HSO regarding the followup actions; the presence of an SSO will not abrogate safety responsibilities of other personnel.

- Daily safety inspections of work areas.

3.0 PERSONNEL AND TRAINING

3.1 Key Personnel

Health and safety is a line management responsibility; and as such, the Project Manager (PM) is responsible for the overall direction, implementation, and enforcement of health and safety for the project. Daily implementation and enforcement of the HSP during field activities will be directed by the Site Manager (SM)/Field Operations Leader (FOL). The SM/FOL will be technically assisted in this function by the SSO. SSO's main function is to serve as a technical advisor to line management in matters regarding health and safety. The SSO will primarily be responsible for the technical and administrative functions relative to health and safety necessary during onsite activities. Additionally, although health and safety is a staff function, the SSO has the authority to stop work if they believe an "imminently dangerous" situation exists. Such a situation will be immediately reviewed by the PM and SM, and the Corporate Health and Safety Manager (CHSM). From a technical standpoint, the SSO will report to CHSM, who is a Certified Industrial Hygienist in Comprehensive Practice, and as such, will serve as the HSO for this project.

All other personnel working on the site will report to the SM and ultimately the PM and, in keeping with OSHA requirements and management principles, are required to comply with all procedures outlined in this HSP.

3.2 Medical Surveillance Requirements

Any personnel working in an exclusion zone, contamination reduction zone, or any other area where potential exposure exists, must comply with medical surveillance requirements outlined in 29 CFR 1910.120(f), and AWD's medical surveillance SOPs.

Documentation regarding medical surveillance will be kept in a health and safety file onsite. Such documentation will consist of physician approval letters stating that an individual is qualified to work on a hazardous waste site in accordance with 29 CFR 1910.120(f) and medical data forms of all personnel who work at the site. The medical data sheets include requirements for corrective lenses, personal physician, and next of kin.

3.3 Employee, Supervisor, and Visitor Training

All personnel must meet health and safety training regulations outlined in 29 CFR 1910.120(e). This will primarily involve exclusion zone and contamination reduction zone workers; hence 40-hour introductory, refresher, and supervisory training requirements for supervisory personnel will apply. There may be site visitors who fall under OSHA's 24-hour training provisions, and any decision regarding applicability of these provisions will be made by the HSO.

To comply with OSHA's site-specific training requirements, the HSO will conduct a training session immediately preceding field activities. This training will be attended by applicable personnel and will address HSP elements, integrated with any other applicable requirements. Any need for additional site-specific training due to changes in the work force will be conducted by the SSO. The SSO will also be responsible for weekly safety training for onsite personnel and "visitor" briefings.

3.3.1 Site-Specific Training

The content of the site-specific training program, which will include instructions concerning possible hazards, is outlined below:

- Introduction to the hazardous materials previously identified at the site
    - Definition of hazardous materials
    - Classification of hazardous materials
    - Potential for ignitability, corrosivity, reactivity, and/or toxicity
    - Possible radiological hazards
- Toxicological impacts of possible contaminants
    - Expected exposure levels
    - Routes of probable exposure
        - -- Respiratory tract
        - -- Dermal penetration
    - Expected toxic effects

- ACGIH threshold limit levels
- Carcinogens

- Emergency planning and principles to be used on the job site

  - Emergency medical care and treatment
  - General safety practices
  - Emergency telephone numbers
  - Onsite communications
  - Names and responsibilities of key project safety personnel

- Respiratory protection level used onsite

  - General principles
  - Potential hazards
  - Protective measures provided by air monitoring
  - Response (evacuation) requirements activated by abnormally high volatile organics in ambient air

- Protective clothing requirements

  - Level of protection
  - Articles of protective clothing
  - Purpose of each article of protective clothing
  - Proper use of protective clothing

- Decontamination

  - Concern regarding proper decontamination
  - Extent of decontamination required
  - Personnel decontamination under normal conditions
  - Personnel decontamination during medical emergencies
  - Decontamination of equipment
  - Disposal of contaminated materials

Personnel will be required to sign a document at the conclusion of the training program stating that they understand and will abide by the provisions found in this HSP.

Additionally, prior to the initiation of work each day, a safety meeting will be held to discuss any modifications to this HSP that may have been warranted based on the activities during the previous day.

TABLE V.1

CHEMICAL AND PHYSICAL PROPERTIES OF KNOWN/SUSPECTED SITE CONTAMINANTS

Contaminant (CAS No.)	OSHA PEL's NIOSH REL's ACGIH TLV's IDLH Value	Routes of Exposure	Warning Property Rating and Proper Air-Purifying Cartridge	Appearance and Odor	Relative Response Ratios and Recommended Probe/Span Settings	Description of Acute and Chronic Health Effects and Carcinogen Listing	Physical Properties
Chloroform (67-66-3)	OSHA 2 ppm - TWA NIOSH 2 ppm - 60 min ACGIH 10 ppm - TWA IDLH 1,000 ppm	Inhalation Ingestion Contact	Inadequate	Colorless liquid with a pleasant odor	OVA response: 65% PID response: 49% with 11.7 eV lamp	Irritating to the skin and eyes. May cause headache, dizziness, nausea, fatigue, and disorientation. May product liver, kidney, and heart disorders. Carcinogenicity: This compound is classified as an occupational carcinogen by NIOSH and a suspected human carcinogen by ACGIH.	MW: 119.4 BP: 143°F Sol: 0.5% Fl.P.: NA I.P.: 11.42 eV V.P.: 160 mm LEL: NA UEL: NA Source: NIOSH Pocket Guide

TABLE V.1

CHEMICAL AND PHYSICAL PROPERTIES OF KNOWN/SUSPECTED SITE CONTAMINANTS

Contaminant (CAS No.)	OSHA PEL's NIOSH REL's ACGIH TLV's IDLH Value	Routes of Exposure	Warning Property Rating and Proper Air-Purifying Cartridge	Appearance and Odor	Relative Response Ratios and Recommended Probe/Span Settings	Description of Acute and Chronic Health Effects and Carcinogen Listing	Physical Properties
Methylene Chloride (75-09-2)	OSHA 500 ppm - 8 hour 1,000 ppm - Ceiling 2,000 ppm - 5 minute maximum in any 2-hour period NIOSH Lowest feasible concentration ACGIH 50 ppm - 8 hour IDLH 5,000 ppm	Inhalation Ingestion Contact	Inadequate	Colorless liquid with a chloroform-like odor	OVA response: 90% PID response: 77% with 11.7 eV lamp	Acute - Fatigue, weakness, sleepiness, light headed, numbness in limbs, nausea, eye and skin irritation. Chroni - Dermatitis possible upon prolonged contact, may effect liver and kidney function upon prolonged exposure, may also effect central nervous system and cardiovascular system. This substance is listed as a suspected human carcinogen.	MW: 84.9 BP: 104°F Sol: 2% I.P.: 11.32 eV V.P.: 350 mm UEL: 22% LEL: 14% Source: NIOSH Pocket Guide

TABLE V.1

CHEMICAL AND PHYSICAL PROPERTIES OF KNOWN/SUSPECTED SITE CONTAMINANTS

Contaminant (CAS No.)	OSHA PEL's NIOSH REL's ACGIH TLV's IDLH Value	Routes of Exposure	Warning Property Rating and Proper Air-Purifying Cartridge	Appearance and Odor	Relative Response Ratios and Recommended Probe/Span Settings	Description of Acute and Chronic Health Effects and Carcinogen Listing	Physical Properties
Tetrachloro-ethylene (127-18-4)	NIOSH Lowest feasible concentration OSHA 25 ppm - 8 hour ACGIH 50 ppm - 8 hour 200 ppm - STEL IDLH 500 ppm	Inhalation Ingestion Contact	Adequate Organic vapor cartridges Facepiece selected based on protection factor	Colorless liquid with a mild, chloroform-like odor	OVA response: 70% PID response: ~80% based on trichloroethylene response	Acute - Eye, nose, and throat irritation, dizziness, headache, skin reddening. Chronic - Liver injury. This compound is listed as a human suspected carcinogen.	MW: 165.8 BP: 250°F Sol: 0.02% Fl.P.: NA I.P.: 9.32 eV V.P.: 14 mm Source: NIOSH Pocket Guide

TABLE V.1

CHEMICAL AND PHYSICAL PROPERTIES OF KNOWN/SUSPECTED SITE CONTAMINANTS

Contaminant (CAS No.)	OSHA PEL's NIOSH REL's ACGIH TLV's IDLH Value	Routes of Exposure	Warning Property Rating and Proper Air-Purifying Cartridge	Appearance and Odor	Relative Response Ratios and Recommended Probe/Span Settings	Description of Acute and Chronic Health Effects and Carcinogen Listing	Physical Properties
Trichloro-ethylene (79-01-6)	OSHA AND ACGIH 50 ppm - TWA 200 ppm - STEL NIOSH 25 ppm - TWA IDLH 1,000 ppm	Inhalation Ingestion Contact	Adequate Full-face required Organic vapor cartridges	Colorless liquid with a chloroform-like odor	OVA response: 70% PID response: 89%	Acute - Headache, visual disturbances, eye irritation, cardiac arrythmia, tremors, nausea, vomiting, dermatitis. Chronic - Liver and kidney damage, polyneuropathy, respiratory ailments. Carcinogenicity - This compound is listed as an occupational carcinogen by NIOSH.	MW: 131.4 BP: 189°F Sol: 0.1% Fl.P.: 90°F I.P.: 9.45 eV V.P.: 58 mm LEL: 8% UEL: 10.5% Source: NIOSH Pocket Guide

TABLE V.1

CHEMICAL AND PHYSICAL PROPERTIES OF KNOWN/SUSPECTED SITE CONTAMINANTS

Contaminant (CAS No.)	OSHA PEL's NIOSH REL's ACGIH TLV's IDLH Value	Routes of Exposure	Warning Property Rating and Proper Air-Purifying Cartridge	Appearance and Odor	Relative Response Ratios and Recommended Probe/Span Settings	Description of Acute and Chronic Health Effects and Carcinogen Listing	Physical Properties
1,1,1-Tri-chloroethane (71-55-6)	OSHA and ACGIH 350 ppm - TWA 450 ppm - STEL NIOSH 350 ppm - Ceiling IDLH 1,000 ppm	Inhalation Ingestion Contact	Adequate Organic vapor cartridges	Colorless liquid with a mild, chloroform-like odor	FID response: 105% PID response: 74% with 11.7 eV lamp	Exposure may cause headache and dizziness. Eye irritation and dermatitis may occur upon direct contact. This compound may also cause cardiac arrythmia. Damage to liver and kidneys is also possible upon prolonged exposure. Carcinogenicity: Not listed.	MW: 133.4 BP: 165°F Sol: 0.4% Fl.P.: None I.P.: 11.00 eV V.P.: 100 mm LEL: 7.5% UEL: 12.5% Source: NIOSH Pocket Guide

4.0 HAZARD ASSESSMENT

4.1 Chemical Hazards

Previous site investigations have indicated the presence of chlorinated and nonchlorinated volatile organic compounds (VOCs) in the subsurface water below the Enviro-Chem Site. These compounds include, but are not limited to, 1,1,1-trichloroethane, trichloroethene, tetrachloroethene, chloroform, and methylene chloride. Other chemicals expected to be encountered are toluol, ethylbenzene, and isophorone.

Because most of the contaminants detected onsite have relatively high vapor pressures, the primary exposure pathway during field activities will be via inhalation. However, a potential dermal contact exposure pathway will also exist during remedial activities. The ingestion of contaminants is not likely if normal precautions concerning personal hygiene are followed.

The individual tables in Section 4.1.1 present health hazard data indicated in the National Institute for Occupational Safety and Health's (NIOSH's) "Pocket Guide to Chemical Hazards," June 1990.

Of the primary substances detected during the RI, the lowest threshold limit value for an 8-hour exposure is 2 ppm. Therefore, if air monitoring during the site investigation indicates an average organic vapor concentration above the background level, Level C respiratory protection (air purifying respirators with GMC-H canisters) will be required. If average organic vapor concentrations exceed 5 ppm above the background level, the exclusion zone will be evacuated, and all personnel will rendezvous in the support zone. It may be determined that work can continue at the site with Level B respiratory protection (self-contained breathing apparatus).

Because the available data show a moderate level of dermal toxicity, chemical-resistant gloves (e.g., neoprene or nitryl) will be required for any task in which dermal contact with contaminated materials is possible.

In addition to the inhalation and dermal pathways, other exposure pathways are potential hazards to onsite personnel. Although they are less hazardous than the inhalation and dermal contact routes, precautions should be taken to avoid the following potential exposure pathways:

- Ingestion of contaminated subsurface or surface water
- Ingestion of contaminated surface soil
- Eye contact with any contaminated materials

To mitigate these potential hazards, a thorough program of personnel decontamination and hygiene will be maintained during remedial activities. Also, splash protection (e.g., goggles, neoprene boots, and chemical resistant gloves) will be used during the sampling or handling of any contaminated liquids and during steam cleaning. Details on personal protective equipment and procedures are provided in Section 6.0 of this HSP. Specific steps for decontamination of equipment are included in Section 8.0.

4.1.1 General Description of Chemical Hazards

Halogenated Hydrocarbons: Vapor inhalation toxicity increases in the order fluorinated, unhalogenated, chlorinated, brominated, iodinated. All cause narcosis and unsaturation has little or no effect. Many sensitize the heart to epinephrine (adrenaline). Thermal decomposition produces hydrohalic acids.

Methylene Chloride is a colorless liquid with a penetrating ether-like odor that is irritating at high concentrations. Forms flammable vapor-air mixtures. Open flames and welding arcs can cause thermal degradation with the evolution of hydrogen chloride and very small amounts of phosgene and chlorine.

1,1,1-Trichloroethane is a suspect carcinogen, poisonous by ingestion, intravenous, and subcutaneous routes. This compound is moderately toxic by inhalation, skin contact, and intraperitoneal routes. An eye and severe skin irritant. Has narcotic properties and acts as a local irritant to the eyes, nose, and lungs. It may be injurious to the liver and kidneys.

Chloroform is a confirmed carcinogen, and a human poison by ingestion and inhalation. Moderately toxic experimentally by intraperitoneal and subcutaneous routes. Produces systemic

effects by inhalation: hallucinations and distorted perceptions, nausea, vomiting, and other unspecified gastrointestinal effects.

Trichloroethene is a suspected carcinogen, and is an experimental poison by intravenous and subcutaneous routes. Moderately toxic by ingestion and intraperitoneal routes. Mildly toxic by ingestion and inhalation. An eye and severe skin irritant. Inhalation of high concentrations causes narcosis and anesthesia. A form of addiction has been observed in exposed workers. Prolonged inhalation of moderate concentrations causes headache and drowsiness.

Tetrachloroethene is a confirmed carcinogen, and an experimental poison through intravenous route. Moderately toxic by inhalation with the following effects: local anesthetic, conjunctiva irritation, general anesthesia, hallucinations, distorted perception, coma, and pulmonary changes. Moderately toxic by ingestion, inhalation, intraperitoneal, and subcutaneous routes. May cause reproductive failure. An eye and severe skin irritant. Liquid can cause injuries to the eyes. Symptoms of acute intoxication from this material are result of effects upon the nervous system. Can cause dermatitis. Irritates the gastrointestinal tract upon ingestion.

Aromatics: Aromatic hydrocarbons have pleasant odors, and all are narcotic and irritating to mucous membranes. They pose substantial fire/explosion hazards.

Toluol (toluene) may produce irritation to the eyes, skin, and respiratory tract. The central nervous system may be effected in the form of tremors, nervousness, fatigue, dizziness, etc. May emit toxic fumes when heated to decomposition. May react with oxidizers.

Ethylbenzene is moderately toxic by ingestion and intraperitoneal route. Mildly toxic by inhalation and skin contact. Experimental reproductive effects. Systemic effects by inhalation are eye, sleep, and pulmonary changes. An eye and skin irritant. A very dangerous fire and explosion hazard when exposed to heat or flame.

Ketones: Are narcotic irritants and the irritation of the eyes and nasal passages usually will limit acute exposure. Increasing molecular weight brings increase in narcotic potential, irritation, and general toxicity. All commercially important ketones are potential fire/explosive hazards.

Isophorone is moderately toxic by ingestion and skin contact. Mildly toxic by inhalation. Systemic effects by inhalation are olfactory changes, conjunctiva irritation, and respiratory changes. A skin and severe eye irritant. Questionable carcinogen. Chiefly a kidney poison. Flammable and explosive when exposed to heat or flame.

4.2 General Physical Hazards

The primary physical hazards associated with the site are heat stress and cold weather exposure. Other potential physical hazards to onsite personnel include falling, tripping, slipping, excessive noise, or fatigue. Work on or around heavy equipment is of a safety concern as well.

Heat stress may be of concern depending on the ambient temperature and type of protective clothing required during the site remediation. Impermeable protective clothing, such as chemical-resistant coveralls, will reduce the body's ability to dissipate heat, thus increasing the chance of heat-related problems.

Heat exhaustion is a response to heat characterized by fatigue, weakness, and collapse because of the inadequate intake of water to compensate for loss of fluids through sweating. Heat stroke is a response to heat characterized by extremely high body temperature and disturbance of the sweating mechanism. Heat stroke is an immediate, life-threatening emergency for which medical care is urgently needed.

One or more of the following control measures will be used to control heat stress:

- Employees will be informed of the symptoms of heat stress and heat exhaustion.
- An adequate supply of cold water or a commercial mix, such as Gatorade, will be provided to all employees.
- Employees involved in work tasks requiring the use of impermeable clothing will be required to take periodic breaks.
- All breaks will be taken in a shaded area where employees will be required to remove impermeable protective garments during rest periods.

- Will follow AWD SOPs.

- All employees will be informed of the importance of adequate rest, replacement of lost body fluids, and proper diet to prevent heat stress.

- All employees will be monitored for heart rate and body weight changes which may indicate that more frequent breaks and/or more fluid intake is required.

Cold weather exposure is an occupational stress of concern. Several factors influence the development of a cold weather related injury: (1) ambient temperature, (2) wind velocity, and (3) the presence of moisture. The following precautions will be used to avoid potential frostbite injuries or hypothermia during the field activities:

- Cold weather exposure hazards will be discussed during the safety training program covered prior to the initiation of field activities.

- Thermal socks, thermal underwear, hard hat liners, or other cold weather gear will be provided to employees.

- Periodic breaks will be required during cold weather field activities and warm drinks will be provided.

- Employees who become wet from perspiration or precipitation will be instructed to change clothes.

- Employees will be instructed to recognize the symptoms of exposure and frostbite.

- Follow AWD SOPs.

There is a risk of injuries resulting from falls, tripping over tools or equipment, slipping on wet surfaces, or exposure to noise in excess of acceptable limits. Field personnel will be made aware of the fact that protective apparel and equipment may limit visibility, hearing, and manual dexterity.

- Contact with Energized Sources

  During any field activities which involve work around live utilities, a potential exists for the machinery involved to come in contact with energized sources. The results of this could lead to fire/explosion and/or electrocution. Additionally, personnel could come in contact with energized parts of machinery causing electrocution. Control efforts for these hazards include requirements that machinery onsite be properly maintained, positioned, guarded, and operated by competent personnel. No equipment shall be permitted within a 20-foot radius of energized sources with nominal voltage below 300 kV. Any areas targeted for subsurface investigations shall first be investigated to determine the presence of underground utilities. A representative of the utility commission is to clear any location prior to the commencement of any subsurface activities by contractors. Documentation with respect to this clearance is to be recorded in the appropriate TL's logbook.

- Heavy Equipment Operation

  Considerations for controlling the movement of personnel and equipment in a construction area are vitally important to any project, as injuries may occur while working with or adjacent to such equipment. This category can include moving heavy equipment and cranes and hoists, which present the potential hazards of snapping cables, sling, and ropes. The following controls, in addition to relative standard operating procedures, will be implemented during the entire project:

  - Workers shall adhere to all applicable standards and regulations for performing construction/removal work (29 CFR 1926, etc.).

  - Operators will be trained and experienced in the use of their equipment.

  - Equipment shall be properly guarded.

  - Equipment will be checked on a daily basis for "roadability."

- Signals will be given to the operators of both equipment and vehicles in any work area by one designated person.

- All personnel will stay a minimum of 2 feet clear of the operational area of the equipment.

- No personnel will stand directly underneath any load or piece of equipment, i.e., manlift, backhoe bucket, etc.

- Any unsafe equipment will be removed from service until safety defects can be corrected. Equipment shall be shut down and locked out before maintenance is begun.

- Equipment operators will not leave their machine unattended while it is running.

- All equipment will have electronic backup alarms.

- The speed limit on the site will be 10 miles per hour (mph) for all vehicles.

- No vehicles or equipment will be operated in a careless or unsafe manner.

- Personnel will wear appropriate PPE when working with heavy equipment. Dermal protection must fit properly and be taped to prevent "caught on" or "caught between" hazards.

- Manual Lifting

Improper lifting techniques can lead to back strain and/or related injury. During lifting tasks, personnel are to lift with the force of the load suspended or distributed on their legs and not by their backs. Additionally, the appropriate number of personnel must be used when lifting or handling heavy equipment. These procedures are to be implemented to minimize the potential for back strain.

- Fire/Explosion

  Fuel may still be present in tanks and drums remaining at the site. Although the type of fuel is unknown, fuel is capable of forming flammable/explosive atmospheres. Precautions must be taken during fuel transfer to minimize the risk of fire and explosion. This should consist of monitoring for explosive atmospheres, using non-sparking tools whenever possible, and isolating/eliminating all onsite ignition sources, as well as grounding transfer lines. Fire watches will occur during hot work and in other work situations deemed necessary by the SSO.

- Noise

  Certain operations involving heavy equipment may present noise levels exceeding the OSHA Action Level of 85 dBA and possibly the OSHA PEL of 90 dBA. Hearing protection will be available during site activities and the SSO will evaluate the need to wear this protective gear based on sound level measurements and noise dosimetry. Refer to state OSHA requirements for different action levels.

- Weather-Related Hazards

  Weather-related hazards include heat, cold, rain, snow, electrical storms, etc. All of these hazards will typically correlate to the season in which field activities occur. No outside work will occur during electrical storms. Work cessation due to other adverse weather conditions will be at the discretion of the SM and SSO.

4.2.1 Onsite Subsurface Drilling

Activities are expected to entail subsurface drilling and well installation onsite. Due to the hazardous nature of drilling, a comprehensive driller safety guide is included in Appendix E of this HSP. All applicable guidelines are expected to be followed during drilling operations.

The SSO will verify and document that all personnel meet applicable OSHA training requirements. Additionally, all onsite training sessions will be referenced in the health and

safety logbook and recorded on a training log. All training recordkeeping will be kept in the onsite health and safety file.

4.3 Radiological Hazards

At the time this HSP was developed, no determination has been made as to the presence of radioactive material onsite. Although reports indicate 20,000 pounds of waste was shipped to Enviro-Chem under control of the Department of Energy which may contain low level radiation, no confirmation has been made as to whether the waste has been removed or presently remains onsite. Therefore, screening with a radiation survey meter will be conducted prior to any work in a specific area and during all intrusive activities. The RAD meter is a Bicron S-50 utilizing an end window Gieger-Mueller probe, capable of detecting radiation sources which are in excess of: 3 meV (alpha), 45 KeV (beta), and 6 KeV (gamma). Detection of radiation between .2 and 2 mr/hr will require the use of full Level C dress with GMC-H cartridges and constant monitoring. If detection above 2 mr/hr is detected, all work will cease and personnel will immediately withdraw from the area. Further work in the area will be first discussed with the CHSM and MC. In addition to monitoring with a red meter, personnel will be required to wear a dosimeter that can measure individual exposure to radiation.

5.0 SITE CONTROL MEASURE

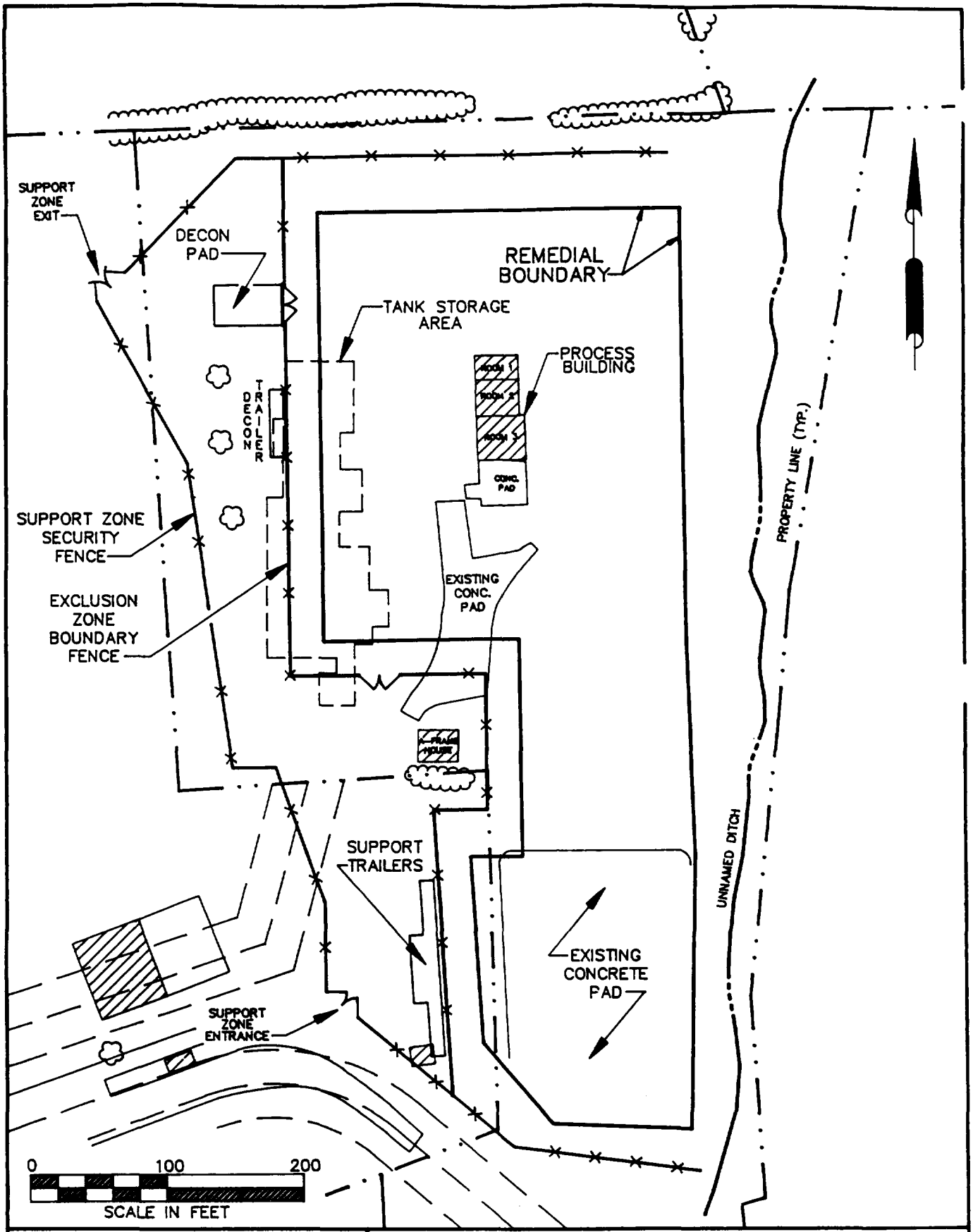
5.1 Work Zones

The exclusion zone (EZ) will be designated as the specific location where intrusive activities occur, i.e., sampling, trenching, etc. will take place. The EZ will be physically barricaded by means of caution tape/flagging and/or construction barricades, and will serve as a visual indicator to personnel to wear the prescribed personal protective equipment (PPE) in the affected area. Each specific work location will also contain a personnel decontamination station as part of the contamination reduction zone (CRZ). The variable CRZs will be determined by the SSO in conjunction with the SM or TL respectively before work commences in the given area. A fence currently runs around the perimeter of the Enviro-Chem Site which will help eliminate entry of unauthorized persons.

The field activities support zone, where support facilities (i.e., a trailer and site vehicles, if applicable) will be located, will be in a controlled area on the property. If an office trailer is placed at the site, it may be utilized for shelter by all personnel conducting business at the Enviro-Chem Site. This zone will be in an area where contamination is not suspected. Personnel exiting any designated exclusion zone will be required to go through the prescribed level of decontamination before entering any support area. Additionally, the storage of any contaminated materials in the support zone will be expressly prohibited.

Decision-making criteria for each work area setup takes into account the following:

- Site historical information
- Suspected dimensions of the contaminated area
- Physical and topographical features of the site
- Weather conditions
- Access requirements
- Physical, chemical, toxicological, and other characteristics of the substances present
- Cleanup activities required
- Potential for fire
- Area needed to conduct operations



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PROPOSED BOUNDARIES OF SUPPORT ZONE AND EXCLUSION ZONE

ENVIRO-CHEM SUPERFUND SITE — ZIONSVILLE, IN

CLIENT: ENVIRONMENTAL CONSERVATION & CHEMICAL CORP. TRUST — JOB NO. 2259-553

SCALE: AS SHOWN — FIGURE NUMBER — REV 0

FILE: \ECC\FIG8-1.DWG 12/30/93

- Decontamination procedures
- Potential for exposure

The three-zone approach assumes that an appreciable exposure scenario exists. In situations involving negligible exposure potentials (i.e., surface activities), site zoning procedures may be modified following approval of the SSO. In all instances, applicable information will be appropriately communicated to personnel.

No employees will be permitted to enter any exclusion zone or any other area where there is a potential for chemical exposure unless they have the appropriate medical clearance, training, and PPE. Keeping current medical and training documentation onsite will enable the SM, TLs, and SSO to ensure that unauthorized personnel do not enter a restricted work area. Each TL will be responsible for identifying and controlling the personnel and equipment in their respective work area. This will be accomplished via daily logbook entries. Additionally, all personnel passing through the decontamination trailer (entering the controlled area of the site) will sign a daily tracking sheet indicating their entrance into the controlled area. All exclusion zone work shall require that the buddy system be used.

5.2 Markings/Signs

The following markings/signs will be used as visual indicators:

- Exclusion Zone Marking

  The outer limits of the work zones shall be marked with colored surveyors tape. Signs shall be included (i.e., Hazardous Area - Keep Out), as per 29 CFR 1910.145.

- Equipment

  Equipment and vehicles entering the exclusion zone shall remain inside EZ limits until decontamination is accomplished and the item has been cleared to leave the site. These vehicles will be indicated with red flagging on side mirror or equivalent.

5.3 Communications

Emergency telephone numbers and reporting instructions for ambulance, hospital, fire, and police shall be available at the site. All field personnel shall be briefed concerning the people and equipment to be contacted during an emergency.

An internal communication system consisting of hand signals as well as voice communication shall be adopted by field personnel because of potentially noisy working conditions at the site. The hand signals suggested to be used during field operations are:

- Hand gripping throat - out of air, can't breathe
- Grip partner's wrist - leave area immediately
- Hands on top of head - needs assistance
- Thumbs up - OK, I am alright, I understand
- Thumbs down - no, negative

5.4 Security

Security procedures will be under the direction of the SM/FOL.

6.0 PERSONAL PROTECTIVE EQUIPMENT

6.1 General

Although certain engineering and administrative controls, as discussed in other sections of this HSP, will be instituted during site activities, personal protective equipment (PPE) will be used as the primary measure to minimize personnel exposure to hazardous materials. Decision-making criteria for PPE requirements include:

- Historical information
- Known/suspected contamination
- Work location/duration
- Task being performed/method of operation
- OSHA requirements
- Other requirements as directed by applicable regulations

Throughout the course of activities, PPE requirements may need to be modified (upgraded or downgraded) due to environmental concerns/site conditions (i.e., dusty conditions, visual contamination, exceeding monitoring instrument action levels) and/or if additional analytical data becomes available which suggests an increased or decreased level of hazard. All modifications will be directed by the SSO with approval from the HSO.

OSHA requirements (29 CFR 1910.120) dictate that when PPE is used, a PPE program be developed. Similarly, separate requirements are dictated by OSHA for respiratory protection. However, it is realized that there is much overlap between PPE and respiratory protection, since respiratory protection is in fact a facet of PPE. To address these OSHA requirements, site-specific approach to these programs recognizes that PPE/respiratory requirements are dynamic and may vary from project to project. It must be understood, however, that PPE and the Respiratory Protection Program (RPP) directly interface as previously stated.

6.2 General Levels of Protection

The primary levels of protection that may be used during site activities include Levels B, C, and D. While on any site, the minimum personal protection equipment shall consist of hard hat,

safety glasses with side shield that meet ANSI Z-87 specifications, steel toed boots, and long pants):

The following describes the various levels of protection:

Level B

- Respirator

___ Full-face mask, positive-pressure pressure demand, air-line unit with 5 minute escape bottle, remote air supply

___ Full-face mask, positive-pressure pressure demand, self-contained breathing apparatus 30 minute rated (NIOSH/MSHA approved)

Note: MSA HIP air units or MSA dual purpose ultra-lite II units will be used

- Coveralls

___ Tyvek PE (for Splash Protection only)

- Gloves

_X_ Inner latex gloves
_X_ Nitrile
___ Cotton outer (as needed)
___ Leather outer (as needed)

- Hard hat

- Boots (steel toe and shank safety boots (ANSI approved))

___ Bull dog boot covers or tingley rubber boots with steel toe/shank

___ Ear Plugs (as needed)

Level C

- Respirator

X Full-face air-purifying respirator with GMCH cartridges

Note: MSA ultratwin respirators are to be used.

- Coveralls

___ Tyvek PE

- Gloves

X Inner latex gloves
X Nitrile
___ Cotton outer (as needed)
___ Leather outer (as needed)

- Hard hat

- Boots (steel toe and shank safety boots (ANSI approved))

___ Bull dog boot covers or tingley rubber boots with steel toe/shank

___ Ear Plugs (as needed)

Level C protection includes full-faced air purifying respirators equipped with GMC-H cartridges for removing organic vapors, dusts, mists, and fumes. The respiratory protection program shall follow the OSHA guidelines in 29 CFR 1910.134. The guidelines to be followed when using Level C respiratory protection include:

- Air purifying cartridges will be replaced at the end of each shift or as needed.

- Only employees who have had a pre-issue qualitative fit test will be allowed to work under Level C respiratory protection.

- Employees will have been instructed and trained in the proper use of respirators and their limitations.

- Only employees who have passed a medical examination, including a pulmonary function test, will be allowed to use Level C respiratory protection.

- Conditions that prohibit a proper seal between the respirator and face (e.g., facial hair, eyeglasses with earpieces, etc.) will not be allowed. The wearer should check the facepiece fit every time he or she puts on the respirator.

- Respirators shall be regularly cleaned and disinfected.

- Respirators used routinely will be inspected during cleaning and worn or deteriorated parts will be replaced.

- Respirators will be stored in a convenient, clean, and sanitary location.

Modified Level D

- Coveralls

___ Tyvek PE

- Gloves

_X_ Inner latex
_X_ Nitrile
___ Cotton outer
___ Leather outer

- Hard hat

- Eye protection with side shields (ANSI Z-87 approved)

- Boots (steel toe and shank safety boots (ANSI approved))

___ Bull dog boot covers or tingley rubber boots with steel toe/shank

___ Ear Plugs (as needed)

All joints between various garments shall be securely sealed with duct tape as deemed necessary by the SSO.

Level D

- Hard hat
- Eye protection with side shields (ANSI Z-87 approved)
- Steel toe boots and shank

Hearing protection (as needed)

6.3 Summary of PPE Required per Task

Task	Potential Levels of Protection
Mobilization	D
Setup of Equipment	Modified D; D
Concrete Saw Cutting	Modified D
Earth Handling Activities/Trenches	B; C; Modified D
Drilling/Well Installation	B; C; Modified D
Trench Construction	B; C; Modified D
Groundwater Pumping/Handling	C; Modified D
Decontamination	C; Modified D
Demobilization	D
(Modify As Needed)	

7.0 AIR MONITORING/SAMPLING REQUIREMENTS

7.1 Perimeter

Perimeter air monitoring using a photoionization detector or flame ionization detector and a radiation detector will be conducted around the designated exclusion zones as intrusive activities are conducted.

7.2 Industrial Hygiene Sampling

Personnel air sampling will not be conducted at this time due to the short duration of the project and the constant use of respiratory protection during construction activities when exposure possibilities exist.

7.3 Real-Time Ambient Air Monitoring

Organic vapors and lower explosive limit/oxygen percentage will be monitored throughout the remediation project. The primary purpose of this monitoring is to provide immediate feedback to the SSO regarding pollutant releases during remediation activities, so that actions can be taken if necessary to reduce vapor releases in the work area. Monitoring data will be collected for these parameters throughout all site activities.

Real-time monitoring will include the following equipment. VOCs will be monitored using a Thermo Environmental Instruments, Inc. Model 580S PID with an 11.7 eV lamp or its performance equivalent. In addition, a Foxboro organic vapor analyzer (flame ionization detector) will also be used for detection of organic vapors. Both the PID and FID will be used because of sensitivities from the chemicals onsite characteristic of each unit. Lower explosive limits (LEL) and oxygen concentrations will be monitored using an MSA LEL/O_2 meter. The LEL/O_2 meter is used to detect oxygen-deficient, oxygen-enriched, and combustible/flammable/explosive atmosphere.

All monitoring instruments will be calibrated daily in accordance with the manufacturer's recommendations. PID analyzers for VOCs will be calibrated with a 100 ppm isobutylene span gas concentration daily and FIDs will be calibrated daily using a methane span gas.

A radiation survey meter, Bicron S-50, capable of detecting 0 to 50 millirems per hour with an end window Gieger-Mueller probe will be utilized for detection of alpha, beta, and gamma radiation.

A daily log will be kept at the site to record all monitoring data. The data will be summarized as part of a daily report, including parameter, instrument type, air concentration measured, time, and location. All information required by AWD Health and Safety SOPs will be collected.

Monitoring Schedule

Action Levels

MONITORING INSTRUMENT ACTION LEVELS UNLESS OTHERWISE DIRECTED		
	Air Quality Measurement	Response
I. Exclusion Zone Action Level - Volatiles		
PID-FID	0 - 1 ppm above background in Breathing Zone	Level D
PID-FID	1 - 5 ppm above background in Breathing Zone	Level C
PID-FID	Above 5 ppm above background in Breathing Zone	Level B
RAD	0 - .2 mr/hr	Level D
RAD	.2 - 2 mr/hr	Level C - Notify CHSM
RAD	Above 2 mr/hr	Cease all activity; withdraw from area

Action Level - Combustible Atmosphere		
CGI	Less than 10 percent LEL unknowns	Normal monitoring
CGI	Greater than 10 percent LEL unknowns	Continuous monitoring Check offsite impact
CGI	Greater than 20 percent LEL unknowns	Stop work

8.0 DECONTAMINATION PROCEDURES

Decontamination of equipment and personnel will be performed to extend the useful life of safety equipment, to prevent cross contamination of samples, and to prevent worker exposure to hazardous substances. All decontamination activities will be carried out within the contamination reduction zone, and any residuals generated (i.e., decontamination water, disposable gloves, disposable suits, etc.) will be placed in secure containers for disposal in accordance with local, state, and Federal regulations.

8.1 Equipment Decontamination

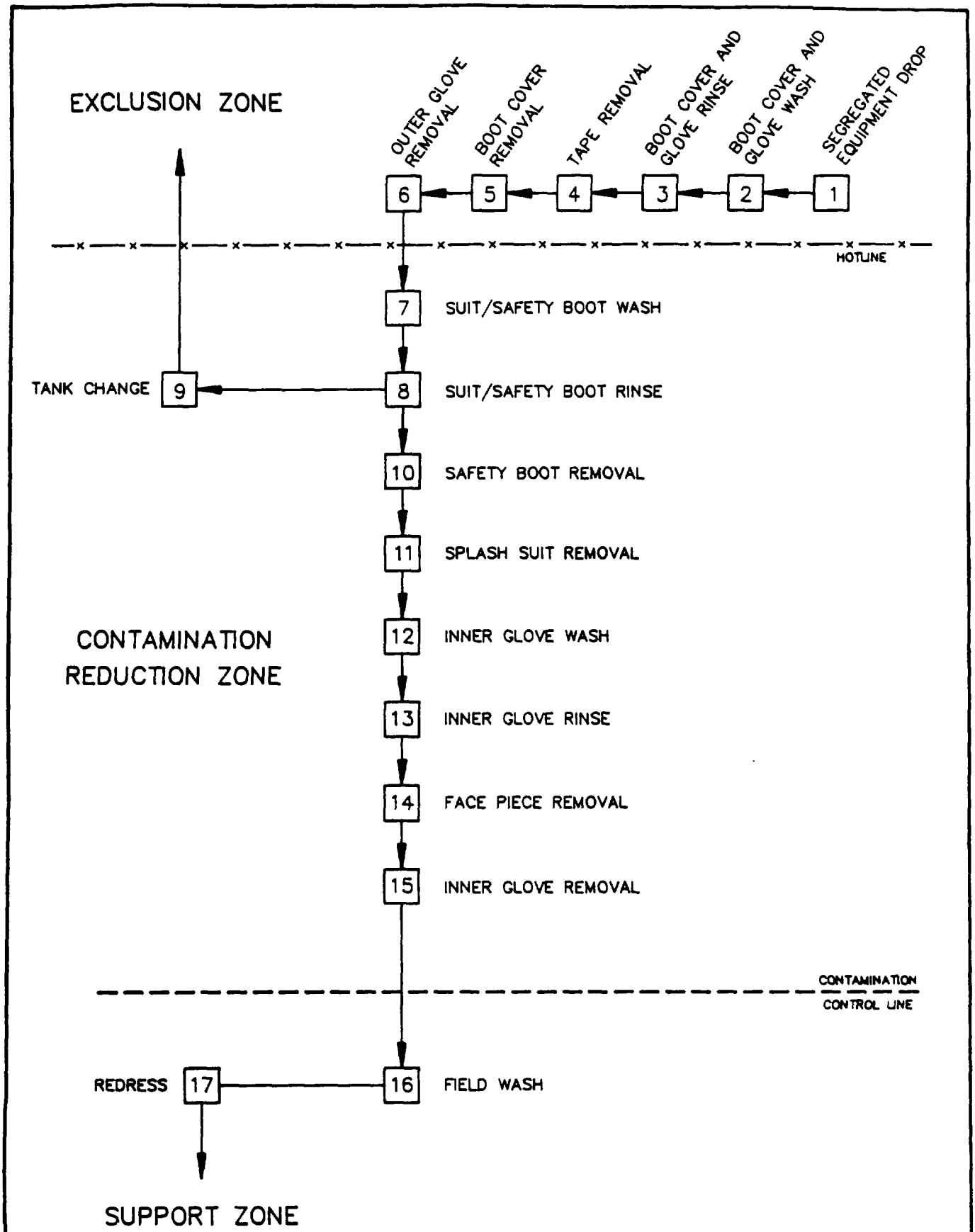
Equipment and sampling tools will be decontaminated to remove any encrusted materials or residual contamination.

The decontamination pad will be constructed during the initial site remediation work. The bottom of this area will be sloped to one end to allow the drainage and accumulation of decontamination washwaters that will be subsequently removed and placed in onsite storage tanks. All steam cleaning, washing, and rinsing procedures will be conducted on this decontamination pad.

8.2 Personnel Decontamination

Personnel decontamination will consist of soap and water washings to remove contaminants from reusable protective gear (i.e., neoprene boots, chemical-resistant gloves, and full-faced respirators). Disposable protective apparel will be removed in a manner that will prevent the spread of contaminants to other clothing (i.e., remove gloves by turning them inside out).

The detailed procedure for personnel decontamination will depend on the level of respiratory and dermal protection required for the specific work task. The general sequence of decontamination and removal of protective apparel is specified in this section (Section 8.0). The extent of washing required or modifications to the sequence will be specified by the SSO.



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DECONTAMINATION PROCEDURES LEVEL C PROTECTION ENVIRO-CHEM SITE, ZIONSVILLE, IN

SCALE: NONE

FIGURE NUMBER

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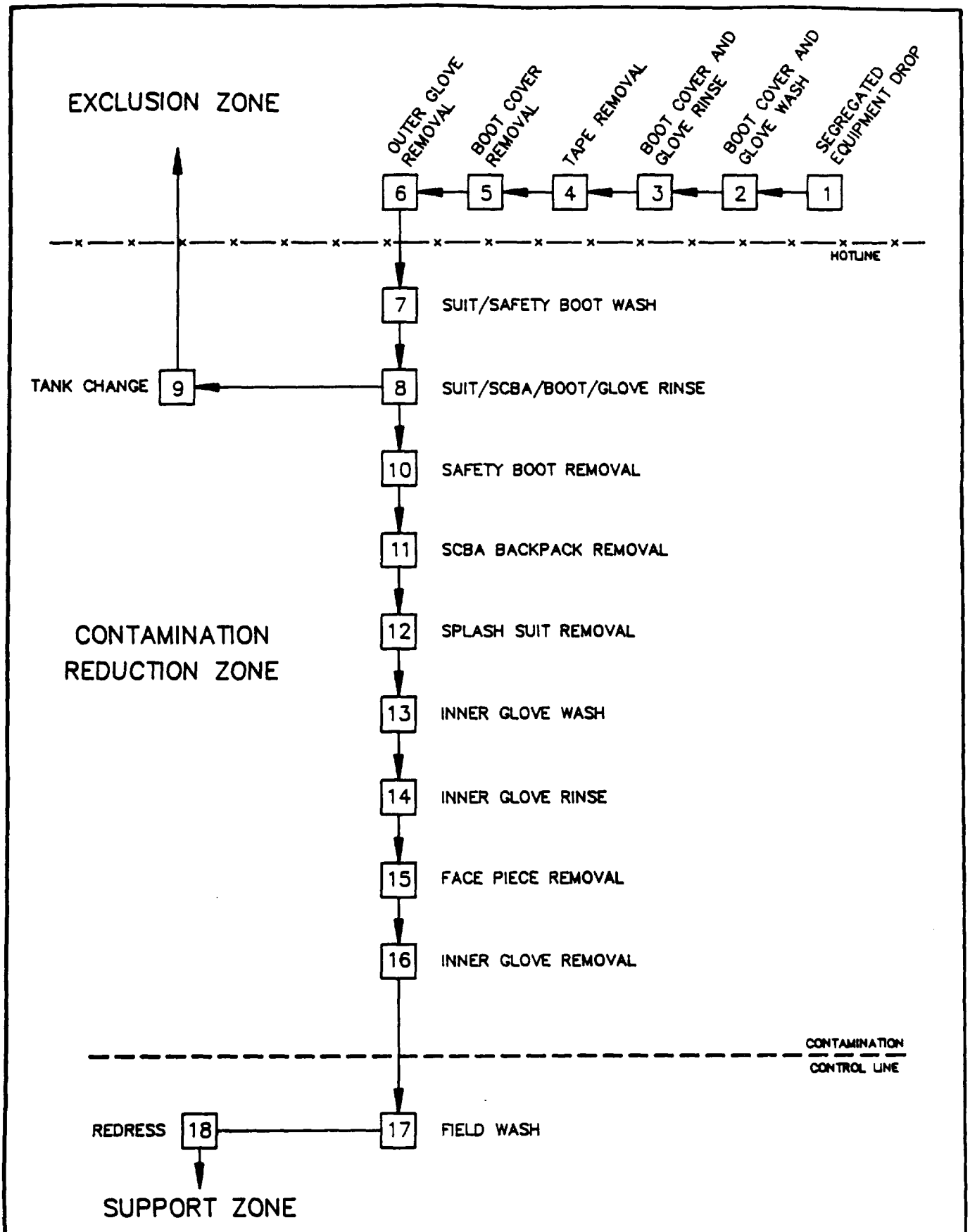

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DECONTAMINATION PROCEDURES LEVEL B PROTECTION ENVIRO-CHEM SITE, ZIONSVILLE, IN

SCALE: NONE

FIGURE NUMBER

REV C

FILE: \FORMS\LEVEL-B

9.0 STANDARD OPERATING PROCEDURES

9.1 General

Various control methods are discussed throughout this HSP, as appropriate to the specific topic or section in question. Institution of these control methods, be they engineering, administrative, or PPE, will lessen or mitigate personnel exposure potential to chemical/physical hazards. Several of these controls were already discussed in this hazard assessment section. Others include:

- No drums will be moved or opened at this time.
- Use of PPE, respiratory protection, and employment of decontamination.
- Implementation of the SOPs included in the SOP section of this HASP.

The following Standard Operating Procedures (SOPs), engineering controls, and/or work practices are to be enforced during work onsite:

- All personnel are responsible for complying with all applicable regulations (i.e., OSHA) for employing safe operating procedures while performing their duties. A copy of OSHA regulations 29 CFR 1910 and 1926 will be kept onsite.

- All personnel must comply with Health and Safety SOPs and pertinent requirements regarding health and safety as depicted in site-specific training. As indicated, these requirements will be kept on the health and safety file onsite.

- All personnel must attend site-specific training prior to working/visiting in the EZ or CRZ.

- All personnel must conduct their activities in a manner pursuant to the contents of this HSP. Violations of HSP requirements will be brought to the attention of the TL by the SSO. If satisfactory results are not obtained, the PM will be advised. Any violation of this HSP may be considered grounds for dismissal.

- All personnel must satisfy medical surveillance requirements prior to working in an area where the potential for exposure exists.

- Any person using prescription or non-prescription drums must first notify the SSO so that it can be determined that these drugs do not potentiate the effects of site contaminants.

- No one may use cosmetics while onsite as these can potentiate the effects of some chemical substances.

- Eating, drinking, smoking, chewing gum or tobacco, or any other hand-to-mouth activities are prohibited in the EZ and/or CRZ due to the potential for contaminant ingestion.

- Upon leaving any designated EZ, personnel must thoroughly wash their hands and face as soon as possible, following personnel decontamination.

- Any unnecessary contact with potentially-contaminated substances must be avoided. This includes contact with potentially-contaminated surfaces and/or equipment. Monitoring instruments and other hand-held items are not to be placed on ground surfaces or other potentially-contaminated surfaces.

- No facial hair, which can interfere with achieving a satisfactory face-to-facepiece seal with respiratory protection equipment, is permitted on any person required to use such equipment.

- Monitoring instrument action levels shall be observed.

- If personnel note any warning properties of chemicals or even remotely suspect the occurrence of exposure, they must immediately notify the SSO for further direction.

- Work cessation due to electrical storms, high ambient heat loads, or other such adverse weather conditions shall be determined by SM and SSO.

- No open fires will be permitted.

- Site personnel are not to undertake any activity which would be considered a confined-space entry without first being trained in the proper procedures by the SSO and completing a confined space entry permit.

- Any areas targeted for subsurface investigation must first be investigated to determine the presence of underground utilities. This information is to be documented in the appropriate TL's logbook.

- No equipment shall be operated within a 20-foot radius of energized power lines.

- No one, under any circumstances, shall enter an excavation without a confined space/limited egress permit and adequate sloping and/or shoring.

- All excavation activities will require that fill be located by the area in question. There is a remote possibility that an unexpected release could occur, compromising personnel protection. In the event this occurs, personnel can smother the affected area with soil via use of the backhoe bucket and then immediately evacuate the area.

- Site rules (buddy system, safety checks before leaving field office, before entering EZ, etc.) shall be enforced.

- Eating and smoking shall be prohibited in the EZ and CRZ, except as identified by the SSO.

- Wearing contaminated protective apparel in the Support Zone and restrooms shall be prohibited.

- Before initiating any non-routine operation in any restricted area, all personnel shall consult the SSO about health and safety requirements for the operations.

- A buddy system shall be implemented for all work in the EZ, including the activities during the pre-operational start-up period.

- In the event of an emergency, an emergency eyewash station in conformance with ANSI Standard Z358.1-1981, will be located onsite. The eye wash shall supply a minimum of 0.4 gallons per minute (gpm) of water for 15 minutes.

- Physician-approved first-aid kits shall be kept onsite during onsite work.

- At a minimum, one 20-pound Type ABC fire extinguisher should be located at each work site. Additionally, all heavy equipment and all dedicated site vehicles shall be equipped with a 10-pound Type ABC fire extinguisher.

- All work areas shall be adequately illuminated by either natural or supplementary electrical lighting. The minimum illumination level in any active work are (i.e., active exclusion zone) shall be 10-foot candles. All other areas of the site shall be illuminated according to the requirements of 29 CFR 1910.120(m).

- All electrical installations shall conform to the National Electric Code, 29 CFR 1926 (Subpart K).

- All loading and unloading of materials onsite shall conform to the requirements of the U.S. Department of Transportation (DOT). These requirements shall including grounding and bonding during flammable liquid transfers; proper placarding of any vehicle transporting hazardous materials from the site; ensuring all drivers meet DOT driver qualifications; and ensuring that all vehicles being loaded or unloaded are secured from inadvertent movement according to DOT and OSHA requirements.

9.2 Drum Handling

No drum handling activities will occur.

9.3 Confined Spaces

No confined space entry permitted at this time.

9.4 Hot Work

No hot work expected at this time.

10.0 ACCIDENT PREVENTION PLAN

This Accident Prevention Plan (APP) has been developed to serve as the accident prevention policy for all personnel, as well as site visitors and site government inspectors, involved with remedial action activities at the site. Where appropriate, certain sections of the APP are completed by referencing pertinent sections of the HSP. Specific information is as follows.

10.1 Responsibilities

Although all personnel play a role in accident prevention, the effective implementation of this plan is dependent on line management. In keeping with previous roles and responsibilities discussed in the HSP and ERP, the Site Manager will be responsible for the implementation and enforcement of this APP. The SSO will perform internal audits at the site and all audit reports will be forwarded to top management. The Site Manager and applicable personnel will be held accountable for any violations to this HSP and/or its components.

10.2 Local Requirements

Besides the requirements listed in the HSP, there are no known local requirements.

10.3 Subcontractor Supervision

Subcontractors will be under the direct supervision of the Site Manager/Field Operations Leader. The subcontractors will be required to follow all provisions of the HSP as part of their subcontract agreement.

10.4 Layout of Temporary Facilities

To be determined at startup of project.

10.5 Sanitation

Decontamination will occur as per the decontamination section of the HSP. Additionally, the number of portable toilets will be designated based on OSHA requirements, as will provisions

for portable drinking facilities/dispensers. Personnel are expected to shower immediately upon arrival at home/hotel.

10.6 Training and Indoctrination/Safety Meetings

The HSP documents all training to be conducted for this project. Included will be OSHA requirements (29 CFR 1910.120) and daily tailgate meetings. The Site Manager or his designee will conduct a daily tailgate meeting and document this meeting on a "Daily Safety Meeting" form.

10.7 Traffic Control and Hazard Markings

Control of moving equipment from contaminated to clean zones will occur via the decontamination procedures described in Section 8.0 of this HSP. Hazard markings relative to work zones will also be as per this section. Other hazards, warnings and/or markings, i.e., hot work, confined space, etc., will be designated as necessary by the Site Manager or respective TL in consultation with the SSO.

Traffic onsite will be restricted by a maximum speed limit of 10 miles per hour. Access/egress will be controlled by appropriate assigned personnel.

10.8 Job Cleanup, Safe Access, Egress

Proper housekeeping will be the responsibility of each TL and ultimately the responsibility of the Site Manager. The TLs will make a daily entry in their logbooks at day's end, indicating that their work area was adequately cleaned prior to employee dismissal. The Site Manager or his designee will make a informal inspection on a daily basis (at day's end) of the main CRZ, shower facility, and support zone.

Safe access and egress regarding traffic is discussed in the traffic control section of this APP. Regarding safe access/egress of personnel into exclusion zones, the TLs will be responsible for accountability of their personnel's location, as discussed in the HSP.

10.9 Fire Protection and Emergencies

Fire protection and emergency information can be found in Section 11.0 of the HSP.

10.10 Jobsite Inspections

The Site Manager and TLs are responsible for daily jobsite inspections of their work area to ensure conformance to HSP requirements, OSHA, and other requirements or recommended practices. The SSO will audit work areas at his/her discretion and will bring any violations/discrepancies with the HSP or recommended practice to the Site Manager's attention. Ultimate resolutions of such violations will be documented in the health and safety logbook. In the event an imminent danger situation exists, as stated in the HSP, the SSO has stop work authority.

10.11 Accident Investigation

Any need to report an incident to outside personnel or agencies will occur as per the HSP. All accidents will be immediately reported to the Site Manager and followed by a written report within 2 working days. This form can be found in Appendix H of this HSP.

10.12 Fall Protection Systems

No work from elevated surfaces is expected at this time.

10.13 Safe Clearance Procedures

Safe clearance procedures regarding electrical utilities can be found in Section 9.0 of this HSP.

10.14 Office Trailer Anchoring System

All site trailers will be anchored using screw-type ground anchors with metal straps.

10.15 Contingency Plans for Severe Weather Conditions

The following severe weather conditions will require shutdown of activities:

- Hurricanes and hurricane warnings
- Lightning (outdoor operations)
- Severe snow or rain storms (at discretion of Site Manager, SSO, and CO)

Any other work shutdown or modification of work activity due to inclement weather will be at the discretion of the Site Manager in consultation with the SSO.

10.16 Mechanical Equipment Inspection

Heavy mobile equipment will be inspected daily as used. TLs shall ensure that any equipment used by the work crew is "checked out" prior to use. The TL shall document usability in his/her logbook.

10.17 Construction/Excavation Safety

All construction/excavation activity shall be monitored by the TL to ensure compliance with OSHA requirements. The TL shall consult the SSO for technical guidance regarding these regulations as necessary.

11.0 EMERGENCY RESPONSE PLAN

This section provides information regarding the action(s) to be taken by site personnel in the event of certain reasonably foreseeable emergencies. The information provided in this section should not be construed as all inclusive as each emergency situation may be unique and should not take precedence over professional judgements made during an incident. This section provides guidance so that logical judgements can be made.

11.1 Pre-Emergency Planning

Pre-emergency planning for this project will involve the following:

- Development and approval of this ERP and a corresponding Spill and Discharge Control Plan (SDCP).
- Coordination of the ERP with local health and emergency response agencies.
- Training of site personnel in appropriate emergency procedures.
- Modification of the ERP, whenever necessary, as conditions change.

11.2 Anticipated Types of Emergencies

Various emergency situations could possibly occur during remedial activities. These situations include:

- Fire/explosion
- Personal injury/illness
- Chemical spill
- Chemical releases to offsite receptors

The remaining sections of the plan provides information and procedures to be followed in the event any of these scenarios occur (individually or in tandem).

11.3 Lines of Authority, Personnel Roles, and Communication

The lines of authority and responsibilities for emergency action will coincide with the health and safety responsibilities discussed in the HSP. The Site Manager has overall authority for implementation of this ERP and all site emergency actions. This authority will be supplemented by input from the SSO who will act as second in command during emergency situations.

Specific roles and responsibilities to be carried out by site personnel will directly correlate to the nature of the incident. Site workers will be utilized to carry out the various response (or non-response) operations.

Communications during site emergencies will include the following:

- Site communications using alarms and radios
- Offsite communications with local health and emergency response agencies via telephones

Once the situation has been evaluated, local emergency response agencies will be notified, as necessary, via the telephone. Telephones will be located at the site office or mobile telephones will be available. Specific protocol, as to who is to be notified in the event of a site emergency, is presented in the emergency alerting provisions of this ERP.

11.4 Training

During site-specific training, all site personnel will receive the level of training necessary for them to safely and effectively carry out their roles as specified in this plan. Personnel who are merely to evacuate to a safe location during incidents will be provided information regarding safe distances and places of refuge. Other persons, who will actually respond to the incidents, will be trained in the specific response procedures and equipment to be used, such as use of fire extinguishers.

11.5 Emergency Recognition and Prevention

Many emergencies can be prevented by compliance with the HSP and all relevant regulatory standards. However, it is recognized that such emergencies can arise. Visual observation,

employee complaints, and/or air monitoring can aid individuals in identifying, recognizing, and initiating response to emergencies.

11.6 Safe Distances and Places of Refuge

Safe distances and places of refuge will correlate to the wind direction, topography, and the incident. Personnel will be advised to move to an upwind location at least 300 yards from any fires and/or chemical releases, and will be advised to continually monitor wind direction for changes (the crew leader will account for respective personnel). If moving upwind from these types of incidents is not possible without encountering the incident and subsequent exposure potential, personnel will be advised to move crosswind or downwind to a distance necessary to be out of the path of smoke, odors, or releases. During personal injury/illness incidents (unless they involve fires or chemical releases), distances from incidents will be such to prevent interference with emergency response.

11.7 Site Security and Control

Site security will consist of a person or several people designated by the Site Manager to control entry/exit of personnel and equipment to the site during work hours. Site security personnel will coordinate the arrival of any outside emergency services. Unauthorized persons will not be permitted to enter the site during routine work operations or during emergencies.

11.8 Evacuation Routes and Procedures

All personnel will assemble at the site office, unless otherwise instructed, in the event that site evacuation becomes necessary. An alternate assembly point will be the parking lot (in support zone). The Site Manager will be responsible for roll call, i.e., personnel accountability.

11.9 Decontamination

Decontamination during site emergencies will be the same as that for routine site operations, unless there is potential threat to human life or health. In such a situation, decontamination will consist of contaminated clothing removal and wrapping the injured party in a blanket. The vehicle used to transport the victim(s) to the medical facility will therefore be restricted in contacting contamination, and as such, should not be required to undergo decontamination.

TABLE 11-1

EMERGENCY REFERENCE NUMBERS

This site location (EMS address): 865 South, Route 421, Zionsville, Indiana

Emergency Information	Location	Telephone Number
Office	Indianapolis	(317) 469-0703
Ambulance	Zionsville	(317) 873-3363
Hospital Emergency Room	St. Vincent	
Hospital General Information	St. Vincent	(317) 871-2345
Police/Sheriff's Department	Zionsville	(317) 873-2233
Fire Department	Zionsville	(317) 873-3344
HAZMAT Team (Local)	Zionsville	(317) 241-4336
Site Manager		
Health and Safety		
Poison Information Center	National	1-800-762-0727
National Response Center for Environmental Emergency Only	National	1-800-424-8802
Boone County Health Department		(317) 482-3942
Bradford K. Grow (PM)	Office	(317) 469-0703
Gary C. Beswick (CHSM)	Home	(412) 695-0980

EMERGENCY PHYSICIAN ACCESS PLAN

(1) MONDAY THROUGH FRIDAY, 8:00 A.M. - 4:00 P.M. (Eastern Standard Time)

Dial the (800) 229-3674 number. When answered state that:

(a) You are calling from AWD Technologies, Inc.
(b) This is an emergency call.

Program staff will be alerted how to contact the physician designated to provide emergency coverage on that day. Collect calls will be accepted.

(2) EVENINGS, WEEK-ENDS, AND HOLIDAYS

Dial the (800) 229-3674 number. An operator from the answering service will answer the telephone. Do the following.

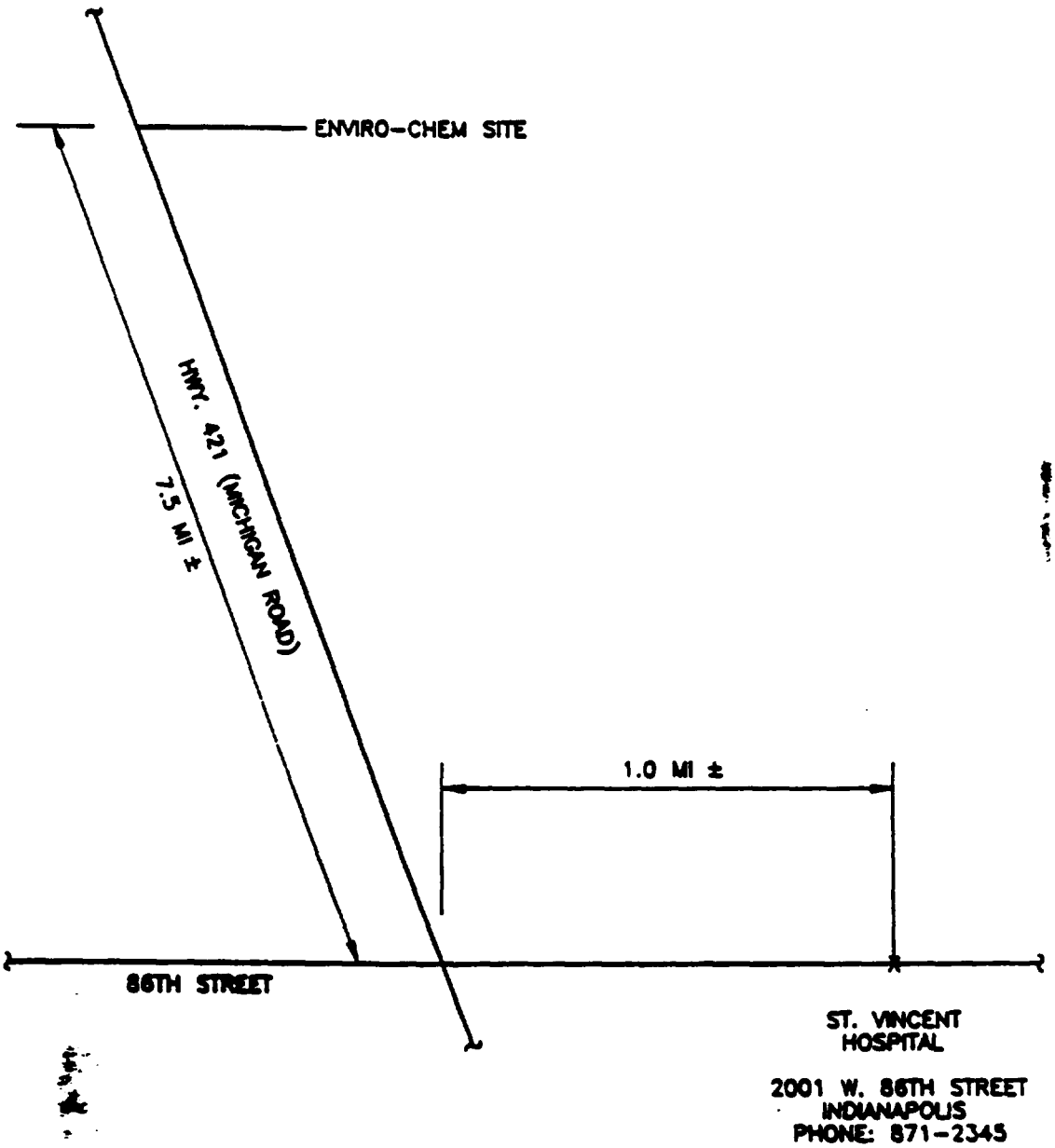
(a) Tell the operator that you are calling from AWD Technologies, Inc.
(b) Tell the operator that this is an emergency call.
(c) Give her your name.
(d) Give her the telephone number where the physician is to call. Be certain that she has written the correct number (area code and seven digits).
(e) If you do not receive a call back within 15 minutes, place a second call to (800) 229-3674.

Collect calls will be accepted.

(3) SITUATIONS WHERE EMPLOYEE REQUIRES IMMEDIATE TRANSPORT TO HOSPITAL

If the situation is life-threatening, i.e., cardiac arrest or person not breathing, call the emergency medical services system and transport the person to the nearest hospital with advanced life support capabilities.

- [redacted]port the accident to the HSSO and the Divisional Health and Safety Representative.
- Develop safe operating procedures to prevent a recurrence.
- File incident report with CHSM Pittsburgh, Pennsylvania.



AWD TECHNOLOGIES, INC

AWD TECHNOLOGIES

HOSPITAL ROUTE
ENVIRO-CHEM SITE, ZIONSVILLE, IN

SCALE	FIGURE NUMBER	REV
NOT TO SCALE	11-1	0

11.10 Emergency Medical Treatment and First Aid

All emergency medical treatment, other than first aid, will be administered by the Paramedic Services dispatched through the emergency dispatch system. This treatment will continue during transportation to the hospital. All first aid will be administered onsite by the SSO who is certified in CPR and first aid by the American Red Cross. Physician-approved first-aid supplies will be maintained at the project site. All vehicles used to transport injured persons to the offsite medical facility will be provided with directions and a map to the facility. Additionally, the HSP will accompany the affected individual to the emergency care center. Figure 11-1 illustrates the route to the hospital from the site.

11.10.1 Emergency Physician Access

In the event that any medical emergency arises due to work-related injuries/illnesses, a 24-hour emergency physician access plan will be established to enable any employee to communicate with the medical consultant.

11.11 Emergency Alerting Procedures

In the event of an emergency, the appropriate response agencies will be notified and appropriate project personnel will be notified as determined in advance. Table 11-1 provides the telephone numbers for the appropriate outside agencies.

11.12 Response Procedures (Priorities and Responses)

The following provides guidance toward prioritizing action and provides general response procedures to be followed. This information coupled with the SDCP should provide adequate information for the degree of response anticipated by employees. It is expected that personnel would only provide minimal or first line response to all emergencies.

11.12.1 First Priority

Prevent further injury/illness by:

- Protecting response personnel
- Isolating the scene to authorized personnel only
- Rescuing any injured parties
- Notifying Outside Emergency Assistance

11.12.2 Second Priority

- Provide first aid to those persons with life-threatening injuries or illnesses.

11.12.3 Third Priority

Alleviate the immediate hazards by:

- Extinguishing incipient stage fires
- Reducing chemical releases
- Containing any spill

11.12.4 Fourth Priority

- Provide first aid to all injured or ill parties and continue efforts to alleviate the hazard.

11.13 Small Fires

A small fire is defined as a fire that can be extinguished with the available 20-pound type ABC fire extinguisher. In the event of a small fire, the following minimum actions shall occur:

- Evacuate all unnecessary personnel from the area, if possible, to an upwind location or to an area not affected by airborne contaminants if an upwind location is not feasible.
- Attempt to extinguish fire using portable fire extinguisher or by smothering.
- Request emergency response assistance (ambulance, fire, hospital, poison control center) as needed for any injuries or exposures to hazardous chemicals.
- Notify the Contracting Officer.

11.14 Large Fires

In the event of a large fire or a small fire which cannot be extinguished, undertake the following minimum actions:

- Evacuate all unnecessary personnel from the site, preferably to an upwind location.
- Order the appropriate level of protective clothing to be worn by personnel near the fire.
- Notify the fire department and other emergency response services (police, ambulance, hospital, poison control center) as needed.
- Notify the Contracting Officer.

11.15 First-Aid Procedures

11.15.1 Physical Injury

- For minor injuries, routine first-aid procedures shall be used immediately. If required, the onsite emergency vehicle shall be used to transport patient to the hospital.

- For major injuries, an ambulance shall immediately be called and paramedics shall assess the nature and extent of the injury. In case of severe injury occurring along with chemical contamination of the victim, the victim shall be sprayed down with a water hose, or have the contaminated garments removed, or be wrapped in a blanket to present the spread of contamination, prior to being transported in the ambulance.

- In the event of bleeding, broken bones, shock, burns, heat exhaustion, heat stroke, seizure, insect stings, etc., the trained personnel shall use Red Cross approved measures for treatment.

11.15.2 Chemical Injury

- Appropriate safety gear shall be worn when treating the victim.

- The victim shall be removed to fresh air and resuscitated, if necessary.

- If clothing is chemically contaminated and injuries permit, clothing shall be removed and the skin flooded with copious amounts of water.

- If the eyes are contaminated, they shall be irrigated immediately with copious amounts of water for 15 minutes minimum.

- Call the nearest Poison Control Center for technical advice and assistance.

11.16 Emergency PPE and Equipment

The following inventory of PPE and equipment will be maintained onsite in sufficient quantities and locations to ensure an adequate supply for all emergency response personnel and to ensure that it is readily accessible:

- Industrial first-aid kit - one in the site office
- Eye wash - located near the work area
- Fire extinguishers - located at each work area
- Tyvek/PE coveralls
- Boot covers
- Nitrile outer gloves
- Duct tape
- Face-shields

11.17 Emergency Response Drills and Critiques

As a "tailgate" review.

TABLE 11-1

EMERGENCY REFERENCE NUMBERS

This site location (EMS address): 865 South, Route 421, Zionsville, Indiana

Emergency Information	Location	Telephone Number
Office	Indianapolis	(317) 469-0703
Ambulance	Zionsville	(317) 873-3363
Hospital Emergency Room	St. Vincent	
Hospital General Information	St. Vincent	(317) 871-2345
Police/Sheriff's Department	Zionsville	(317) 873-2233
Fire Department	Zionsville	(317) 873-3344
HAZMAT Team (Local)	Zionsville	(317) 241-4336
Site Manager		
Health and Safety		
Poison Information Center	National	1-800-762-0727
National Response Center for Environmental Emergency Only	National	1-800-424-8802
Boone County Health Department		(317) 482-3942
Bradford K. Grow (PM)	Office	(317) 469-0703
Gary C. Beswick (CHSM)	Home	(412) 695-0980

12.0 ONSITE REFERENCE/DOCUMENTATION RECORDKEEPING AND REPORTING

The following section provides requirements and procedures that must be instituted for onsite health and safety references, documentation, recordkeeping, and reporting.

12.1 Required References

The following reference material is required to be present in the health and safety file in the site trailer:

- Corporate Health and Safety Manual
- Health and Safety SOPs
- Health and Safety Plan
- Current ACGIH TLV Booklet
- Current NIOSH/OSHA Pocket Guide
- Operational Manual for all health and safety equipment
- 29 CFR 1910
- 29 CFR 1926
- NIOSH/OSHA/USCG/U.S. EPA "Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities"
- American Red Cross First Aid and CPR Instructional Manuals

12.2 Required Documentation

The following documentation must be readily accessible from the onsite health and safety file:

- Written Hazard Communication Program which includes Hazardous Material Inventory and MSDSs.

- Training records for all site workers for the following:

  - 40-hour introductory course
  - 8-hour supervisory course

- 8-hour refresher course
- Site-specific training

- Medical clearance for all site workers.

- Calibration/measurement logs for all site health and safety equipment.

- Health and safety logbook.

- Respiratory Protection Program which meets the requirements of 29 CFR 1910.134.

- Personal Protective Equipment Program which meets the requirements of 29 CFR 1910.120.

- Hearing Conservation Program which meets the requirements of 29 CFR 1910.95.

- Fit-test records for all employee on all types of respiratory protection available onsite.

12.3 Daily Information

The following information must be documented on a daily basis for each site worker:

- Operation(s) performed
- Time spent on each operation ($\pm$ 1/2 hour)
- PPE used for each operation (specific)

The following information must be documented on a daily basis for each operation:

- Monitoring equipment used
- Range (maximum and minimum) for each monitor
- Average reading for each monitor

The following information must be documented on a daily basis for the overall project:

- Environmental conditions (i.e., temperature, precipitation, cloud cover, wind speed, wind direction, etc.).
- Attendance of employees.
- Site visitors (include name, affiliation, areas/operation observed, PPE used, training/medical release, and site training received).
- Observations regarding health and safety of each operation.
- Health and safety problems encountered:
  - Personnel
  - Equipment
- Telephone/site meetings
  - Health and safety concerns discussed
  - Health and safety decisions and rationale

12.4 Training Logs

The training log(s) shall include both initial training, followup training, and visitor training. These logs shall include:

- Date
- Employee's name (attendance check) and record of attendance
- Materials covered
- Fit-testing performed and results
- Trainer(s)'s signature

12.5 Accident/Incident Reports

- Injuries, offsite releases, or accidents shall be reported to the CHSM immediately or as soon after control of the situation as possible.

The responsibility of this recordkeeping and reporting rests with the SM, although the SSO will complete the reports with assistance from onsite administrative personnel. Note that since both a health and safety logbook and logs/reports will be kept, the SSO has the option to incorporate completed logs/reports by reference into the health and safety logbook. All documents will be kept onsite in the health and safety file.

APPENDIX A

SITE-SPECIFIC PPE PROGRAM
(TO BE COMPLETED ONSITE BY SSO
UPON COMPLETION OF MOBILIZATION)

SITE-SPECIFIC PPE PROGRAM

1.0 SITE HAZARDS AND PPE SELECTION

PPE selection is to be based upon exposure potential (i.e., chemical hazards, physical agents, mechanical/physical hazards, et. al) which, in turn, directly corresponds to the site involved and the task being performed.

The requirements set forth are based upon the substances present, potential for contact, and resistiveness of protective clothing, in accordance with available information.

Also take into account various hazard categories and PPE controls including, but not limited to:

Hazards to Consider

Moving, falling, or flying objects
Work above ground level
Pinch-points, nip points, rotating machinery
Noise sources
Contact with energized sources
Heavy objects to lift
Uneven, unstable, or slippery walking surfaces
Handling glass objects
Fire/explosion
Heat stress/cold stress
Biological factors (poison ivy/oak, insects, snakes, etc.)

PPE and Controls to Consider

Hard hats
Puncture resistant gloves
Steel toe/hard sole workboots
Leather work gloves
Safety glasses/goggles/face-shields
Work/rest regime
Electrolyte drinks
Hearing protection
Fall protection
Life-lines/retrieval-lines
Shin guards
Explosion shields
Life-vests
Lineman insulated gloves
Fire extinguishers (specify type)

SITE-SPECIFIC PPE PROGRAM
PAGE TWO

PPE REQUIREMENTS BY TASK (SAME AS TABLE IN HASP)		
Task	Hazard Potential	PPE Control Measures

2.0 PPE USE AND DONNING PROCEDURES

2.1 General Requirements

PPE is to be used as per the task in question. Donning procedures are to be in accordance with the design of the equipment. Special procedures include:

Example: Tape ankle and wrist seams

_____

_____

_____

_____

_____

_____

Donning procedures are to be demonstrated during site-specific training.

2.2 Additional Use Requirements

PPE shall be used in accordance with OSHA 29 CFR 1910 Subpart I.

All loose clothing shall be properly secured to prevent it from becoming caught in moving machinery.

All persons shall be deemed medically qualified to wear PPE prior to use. Medical Approval Forms will be maintained by HSS at the site office.

3.0 WORK MISSION DURATION AND LIMITATIONS DURING TEMPERATURE EXTREMES

Chemical degradation or permeation of Chemical Protective Clothing (CPC) and worker heat/cold stress can significantly affect the length of time a person can work in CPC. Based on the chemicals and concentrations anticipated to be encountered and the anticipated ambient air temperatures, the following restrictions shall apply to this project.

Activity	Restriction

4.0 MAINTENANCE AND STORAGE

PPE will be maintained and stored in accordance with the manufacturers' recommendations. PPE maintenance at this project will be performed by _____ or _____.

PPE at this project will be stored _____. The person responsible for storing and issuing PPE is the HSS. Reusable PPE which is potentially contaminated shall be stored at/in _____.

5.0 PPE DECONTAMINATION AND DOFFING PROCEDURES

PPE decontamination shall be performed in accordance with the corresponding HSP for this project. As per the HSP, the following decontamination requirements shall apply ("X" all that apply):

___ Contaminant Removal from Outer Surfaces of Reusable PPE
___ Contaminant Removal from Outer Surfaces of Disposable PPE
_X_ Doffing (removal) of PPE
___ Disposal of Contaminated PPE
___ Disposal of Decontaminated PPE
___ Personal Hygiene Procedures
___ Onsite Laundering of Potentially Contaminated Work Clothes
___ Offsite Laundering of Potentially Contaminated Work Clothes
___ Other _____

_____

_____

The following details the sequence of decontamination requirements which have been selected (X) for this project, including the two minimum requirements of doffing and personal hygiene:

_____

_____

_____

_____

_____

_____

_____

_____

_____

6.0 PPE TRAINING AND FITTING

All site personnel will be given site-specific PPE training as part of the site-specific health and safety training required by OSHA 29 CFR 1910.120. Documentation of the training shall be in accordance with the HSP. Personnel will receive training on each item of PPE they will be required to use. Minimum requirements shall include the need for PPE, proper use, proper donning/doffing (as previously discussed), and limitations. Any additional requirements are as follows:

_____

_____

_____

_____

PPE training shall be conducted by _____ prior to the worker using the item of PPE.

All site personnel shall be properly fitted for each item of PPE required by the "Use" section of this program.

PPE fitting (excluding respiratory protection) shall be obtained from prior records or shall be conducted by the person responsible for PPE storage and distribution, namely _____, who will maintain a record of sizes as described below:

PPE FIT RECORDS	
Worker	Item (Size)
Example: John Doe	Nitrile Gloves (11), Boot Covers (12), Tyvek (XLG)

7.0 PPE INSPECTION

PPE shall be inspected by the person issuing the PPE and by the worker in accordance with the manufacturers' recommendations.

Worker inspections shall be conducted before, during, and after each use.

The following inspection criteria shall apply for the PPE anticipated to be used.

Item	Inspection Criteria
Example: Nitrile Gloves	No holes or signs of chemical degradation

8.0 PPE IN-USE MONITORING

As discussed in Section 3.0, PPE in-use monitoring shall include observations of chemical degradation or permeation of CPC and signs or symptoms of heat/cold stress.

Site workers are encouraged to report any perceived problem or difficulties with PPE to _____, to include any signs or symptoms of heat stress such as rapid pulse, nausea, or chest paints; discomfort; fatigue; interference with vision or communication; restrictions of movement; unusual residues on PPE; or skin irritations.

Additional in-use monitoring shall be conducted by _____ as described below:

Degradation/Permeation Monitoring:

_____

_____

_____

Heat/Cold Stress Monitoring

_____

_____

_____

9.0 PROGRAM EVALUATION

This program shall be evaluated by _____ at a frequency of _____ in accordance with the following guidelines:

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

These evaluations shall be documented in the field health and safety logbook.

APPENDIX B

SITE-SPECIFIC RESPIRATORY PROTECTION PROGRAM
(TO BE COMPLETED ONSITE BY SSO
UPON COMPLETION OF MOBILIZATION)

SITE-SPECIFIC RESPIRATORY PROTECTION PROGRAM

1.0 SELECTION OF RESPIRATORY PROTECTION

The implementation of this program will be under the direct supervision of _____. In order to simplify this procedure for field implementation, the following action levels have been determined for this project:

Activity/Location	Action Level/ Monitoring Equipment	Required Protection (Be Specific)

2.0 USE OF RESPIRATORY PROTECTION

Based on the site-specific chemical hazards and the anticipated site activities, the following respiratory protection is anticipated to be used at this project.

Activity	Respiratory Protection Anticipated

- Respiratory protection utilized to prevent exposures to toxic chemicals must only be used when accepted engineering controls are not feasible. Administrative controls (i.e., worker rotation) are not considered an accepted control measure to reduce personnel exposures on hazardous waste sites.

- Only approved respiratory protective equipment which has been properly selected for the job shall be used.

- In areas where an employee, because of a failure of a respirator, could be overcome by a toxic or oxygen-deficient atmosphere, at least one additional person shall be present. Communications (voice, visual, or signal line) shall be maintained between all individuals present. Planning shall be such that one individual will be unaffected by any likely incident and he/she will have the necessary rescue equipment to assist the others in case of emergency.

- All personnel onsite must be properly fit-tested for each type of equipment available onsite. The personnel qualified to perform this testing are _____. The records of all fit-tests for site personnel are maintained by _____ and can be reviewed at _____.

- All personnel onsite must be trained in the proper use of each type of respiratory protective equipment available. The following are qualified to conduct this training: _____. Records of this training are maintained by _____ and may be reviewed at _____.

- Respirators shall not be worn when conditions exist which present a poor face-to-facepiece seal. These conditions include, but are not limited to, the growth of a beard or sideburns, a skull cap with projects under the facepiece, or the use of regular corrective glasses because the temper bars prohibit a proper seal. Also, the absence of one or both dentures can seriously affect the fit of any respiratory protection.

- Workers shall only use the respiratory protective equipment which has been assigned to them. Assignment of respiratory equipment will be conducted by _____ in the following manner.

  _____

  _____

- Contact lenses shall not be worn while using respiratory protection unless prior approval is obtained from the CHSM.

- All individuals required to use respiratory protection must successfully pass a physical examination and receive written approval from the examining physician to use both positive and negative pressure respiratory protection. The written approvals for all site personnel are maintained by _____ and may be reviewed at _____.

- The actual use of all respiratory protective equipment shall conform to the manufacturer's operating instructions and training provided to the employee. A copy of all operating instruments for each type of equipment is maintained by _____ and may be reviewed at _____.

- Use of SCBA and APR will be documented by _____. Records will be kept current on a daily basis and can be reviewed at _____.

- Respirator Cleaning - All respirators must be cleaned and disinfected at a frequency necessary to insure that the proper protection is provided to the wearer. Those used by more than one worker must be cleaned and disinfected after each use.

  In order to accomplish this task, a respiratory cleaning station has been set up at _____. This station includes the following items to assist in the cleaning process:

  _____

  _____

  _____

  _____

The following instructions will be posted at the respirator cleaning station to ensure adequate cleaning and disinfection:

_____

_____

_____

_____

_____

_____

_____

_____

_____

SITE-SPECIFIC RESPIRATORY PROTECTION PROGRAM
PAGE FIVE

Based on project logistics, respiratory protection will be cleaned and disinfected by _____. The following schedule for cleaning and disinfection will be followed:

Equipment	Cleaning Schedule	Disinfection Schedule

3.0 RESPIRATOR INSPECTION

All respiratory protection equipment used on a routine basis must be inspected during cleaning. Worn or deteriorated parts must be immediately replaced or the unit tagged and taken out of service. Respirators for emergency use must be inspected at least every 30 days and after each use. Additionally, all respiratory protective equipment must be inspected by the HSSO weekly, regardless of use, and the condition documented on a suitable form signed by the HSSO.

The inspection procedure for each type of equipment will follow the manufacturer's recommended procedure. The specific procedures to be used are available onsite and can be reviewed by contacting _____.

The following schedule will be followed by the HSSO in implementing the inspection requirements:

Equipment	Inspection Date	Person Responsible

4.0 RESPIRATOR STORAGE

All respiratory protection utilized by employees must be stored in a convenient, clean, and sanitary location and according to specific manufacturer recommendations. Special attention must be paid to protecting respiratory protection from dusty conditions, temperatures extremes, and potential contamination during storage.

The following storage procedures will be utilized for equipment used on a routine basis (i.e., storage during non-use periods of a workshift or storage between workshifts):

_____

_____

_____

_____

All equipment not routinely used will be stored according to the procedures outlined below:

_____

_____

_____

_____

Any equipment not assigned to specific site personnel will be stored under the supervision of _____. This equipment will be stored at _____ following the procedures outlined below:

_____

_____

_____

_____

5.0 SURVEILLANCE OF WORK AREA

Appropriate monitoring of the work area conditions shall be performed frequently to establish the degree of employee exposure or stress. In order to simplify this surveillance, the following procedures have been determined for this project:

Monitoring Equipment Used	Frequency of Surveillance	Personnel/Area Monitored

Records of the above surveillance will be recorded on the following forms: (Attach blank field documentation format to be used). Completed forms will be maintained by _____ and can be reviewed at _____.

6.0 QUALITY ASSURANCE OF BREATHING AIR

Compressed air utilized for respiratory protection shall be of high purity. Breathing air shall meet at least the requirements of the specification for Grade D breathing air as established by the Compressed Gas Association. The following specifications must be certified by the vendor/supplier:

Oxygen Content - 19.5 percent to 23.5 percent

Contaminant	Maximum Allowed
Carbon Monoxide (CO)	10 ppm
Carbon Dioxide (CO_2)	1,000 ppm
Condensed Hydrocarbons	5 mg/m^3
Objectional Odors	None

Documentation assuring that breathing air meets the above specifications will be obtained by _____ by requesting such documentation from the vendor or supplier.

Site personnel can review this documentation in the _____.

7.0 PROGRAM EVALUATION

There will be regular inspections and evaluations to determine the continued effectiveness of this program. Documentation will be maintained by _____ and can be reviewed at _____.

The program will be evaluated in the following manner:

APPENDIX C

SITE-SPECIFIC HAZARD COMMUNICATION PROGRAM
(TO BE COMPLETED ONSITE BY SSO
UPON COMPLETION OF MOBILIZATION)

HAZARD COMMUNICATION PROGRAM

Site Name: _____

Location: _____

1. Person responsible for the Hazard Communication Program:

   _____

2. Inventory of hazardous substances is attached and also located:

   _____

   _____

3. Material Safety Data Sheets (MSDSs) for all hazardous substances are located at:

   _____

   _____

4. Employees may review MSDSs and the standard by following this procedure:

   _____

   _____

   MSDSs not on hand, that are requested by employees, will be requested of suppliers within 7 days by letter.

5. The MSDS file is updated with new information and new hazards identified by:

   _____

   Any new hazards will be reported immediately to: _____ and affected employees notified within 30 days.

6. Containers of hazardous materials entering the site will be checked by:

   _____ to assure that they are properly labeled with the chemical name of the contents, the appropriate hazard warning, and the name and address of the supplier or manufacturer.

7. Onsite containers of hazardous materials will be labeled with the chemical name and hazard warning. Exceptions must be approved by:

_____

The following exceptions have been approved: _____

_____

_____

8. Non-routine tasks involving hazardous materials are:

_____

Procedures for complying with the Hazard Communication Standard for these jobs are the following:

_____

_____

_____

_____

9. Employee training is provided initially to all employees and for all new employees. This training covers the following areas:

   a. The basic requirements of the Hazard Communication Standard and their right to information on chemical hazards.

   b. Our company's program to comply with the standards and procedures to follow to see the standard, company program, and MSDSs.

   c. How to interpret and use the labels on containers of hazardous materials.

   d. The potential physical hazards and health effects of the hazardous substances and how to use MSDSs for more information.

e. How to handle the hazardous substances safely and other protective measures in place.

f. What to do in an emergency, release, or over-exposure to the chemicals.

g. How the presence of hazardous chemicals can be detected in the work area.

10. This training is documented in the following manner:

_____

_____

Records are maintained at the following location:

_____

11. Training concerning new hazards (new chemicals or new information on MSDSs) will be provided within 30 days and documented.

12. Periodic refresher training will be provided and documented as follows:

_____

_____

_____

13. Outside employees (subcontractors and visitors) will be advised of chemical hazards at our site in the following manner:

_____

_____

Contractors will be required to provide information on any chemicals used at this site as a condition of their contract.

Our company relies on the information contained in MSDSs as permitted by the OSHA Hazard Communication Standard and does not perform independent hazard determinations.

Reviewed and approved:

_____	_____
HSS	Date
_____	_____
Project Manager	Date

APPENDIX D

SITE-SPECIFIC HEARING CONSERVATIVE PROGRAM
(TO BE COMPLETED ONSITE BY SSO
UPON COMPLETION OF MOBILIZATION)

HEARING CONSERVATIVE PROGRAM

1.0 MONITORING

As per 29 CFR 1910.95, noise monitoring will be conducted by:

_____ (Name/Title)

Such monitoring will consist of (check those that apply):

___ Sound level meter surveying

___ Noise dosimetry

Specific instrumentation to be used is/are (Make/Model):

_____

_____

_____

and it/they will be calibrated at a frequency of _____ and documented in the _____.

Monitoring strategy is as follows: (List all equipment and activities onsite which may involve sound pressure levels above 80 dBA and an explanation of the strategy to document actual exposures.)

_____

_____

_____

_____

_____

_____

_____

All monitoring will be documented utilizing the format illustrated following Section 7.0 (attach form developed for the specific site). These forms will be maintained in accordance with Section 7.0 of this program.

Monitoring frequency will be _____ and when the following changes in site conditions/activities occur:

_____

_____

_____

_____

2.0 EMPLOYEE NOTIFICATION

All site employees exposed above the OSHA action level (85 dBA - 8 hour TWA) will be notified of the monitoring results by _____ (Name/Title) at an interval not to exceed _____ after completion of monitoring.

Notification shall be (check all that apply):

___ Verbal

___ Written

Documentation of employee notifications and corresponding signatures of notified employees will be kept in the health and safety logbook.

3.0 OBSERVATION OF MONITORING

All employees affected by the monitoring or a designated employee representative shall be given the opportunity to observe noise monitoring procedures. This will be achieved by:

_____

_____

_____

_____

4.0 AUDIOMETRIC TESTING PROGRAM AND REQUIREMENTS

Personnel who perform field activities are required to participate in the medical monitoring program which includes audiometric testing meeting the requirements of OSHA 29 CFR 1910.95. Additionally, any subcontractors performing work on projects where noise levels exceeding 85 dBA will be required to provide documentation that they participate in an audiometric testing program which meets the requirements of 29 CFR 1910.95. Documentation of participation in the testing program will be maintained by _____ and will be located at _____

_____.

5.0 HEARING PROTECTORS AND ESTIMATING ATTENUATION

A selection of suitable hearing protectors will be made available to all employees who are expected to have 8-hour TWA noise exposures above 85 dBA. The types anticipated to be available include:

_____ Attenuation _____

_____ Attenuation _____

_____ Attenuation _____

Hearing protector attenuation will be evaluated by _____ for specific noise environments according to the following method prior to determining their suitability for use:

_____

_____

_____

_____

The following site personnel will be required to wear hearing protectors during specific activities as determined in accordance with 29 CFR 1910.95 and the results of site-specific monitoring conducted according to Section 1.0 of this program. (This section can be completed after monitoring, if necessary.)

Name	Activity	Type of Protection Required

Hearing protectors will be properly fitted by _____ upon initial distribution to site workers. Size and type of protector for each employee fitted will be recorded in the PPE form found in SOP _____.

Training in the use and care of hearing protectors shall be conducted by _____ during the initial site-specific health and safety training (as part of the PPE section) required by the Corporate Health and Safety Manual. Training contents shall be as per the requirements set forth in 29 CFR 1910.120.

Hearing protectors will be distributed by _____ from the storage location at the _____.

6.0 ACCESS TO INFORMATION AND TRAINING MATERIALS

All information required by 29 CFR 1910.95 to be made available to the employees will be posted by _____ (Name/Title) at the _____.

OSHA standard 29 CFR 1910.95 will also be kept onsite.

7.0 RECORDKEEPING

Records required by 29 CFR 1910.95 shall be completed by _____ and maintained at the _____ and placed on permanent file at the _____, for the minimum duration required by the standard.

Employees can access their individual records by contacting _____ (Name/Title).

All records required by this section will be transferred to any employees successive employer if the contractor ceases to do business.

APPENDIX E

DRILLING SAFETY GUIDE

DRILLING SAFETY GUIDE

The Drilling Safety Guide has been prepared through the volunteer efforts of members delegations of the Diamond Core Drill Manufacturers Association (DCDMA) and the National Drilling Contractors Association (NDCA).

This guide contains suggested safety procedures. It is not intended nor does it set forth any standard industry procedures or requirements, nor does it contain any procedures or requirements mandated by law. It is to be used as a guideline for the safe operation of drilling equipment. DCDMA and NDCA and their officers and members deny any liability for any injury to persons or property which may occur even if these procedures are properly followed. Further, neither the DCDMA nor the NDCA or their officers or members accept responsibility for the completeness of the guide or the applicability of the statements or procedures to the use of all drilling machines and tools in all environments. Many aspects of drilling safety cannot be expressed in detail and cannot be met by mechanical means, but can only be accomplished with the exercise of intelligence, care, and common sense.

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DRILLING SAFETY GUIDE

1.0 AN INTRODUCTION TO DRILLING SAFETY

The organization where you work is interested in your safety, not only when you are working on or around a drill rig, but also when you are traveling to and from a drilling site, moving the drill rig and tools from location to location on a site, or providing maintenance on a drill rig or drilling tools. This safety guide is for your benefit.

Every drill crew should have a designated safety supervisor. The safety supervisor should have the authority to enforce safety on the drilling site. A rig worker's first safety responsibility is to listen to the safety directions of the safety supervisor.

2.0 GOVERNMENTAL REGULATIONS

All local, state, and Federal regulations, currently in effect or effected in the future, take precedence over the recommendations and suggestions which follow. Government regulations will vary from country to country and from state to state.

3.0 THE SAFETY SUPERVISOR

The safety supervisor should:

- Consider the "responsibility" for safety and the "authority" to enforce safety to be a matter of first importance.
- Be the leader in using proper personal safety gear and set an example in following the rules that are being enforced on others.
- Enforce the use of proper personal protective safety equipment and take appropriate corrective action when proper personal protective safety equipment is not being used.
- Understand that proper maintenance of tools and equipment and general "housekeeping" on the drill rig will provide the environment to promote and enforce safety.
- Be assured, before drilling is started with a particular drill, that the operator (who may be the safety supervisor) has had adequate training and is thoroughly familiar with the drill rig, its controls, and its capabilities.

- Inspect the drill rig at least daily for structural damage, loose bolts and nuts, proper tension in chain drives, loose or missing guards or protective covers, fluid leaks, damaged hoses, and/or damaged pressure gauges and pressure relief valves.

- Check and test all safety devices such as emergency shutdown switches at least daily and preferably at the start of a drilling shift. Drilling should not be permitted until all emergency shutdown and warning systems are working correctly. Do not wire around, bypass, or remove an emergency device.

- Check that all gauges, warning lights, and control levers are functioning properly and listen for unusual sounds on each starting of an engine.

- Assure that all new drill rig workers are informed of safe operating practices on and around the drill rig and should provide each new drill rig worker with a copy of the organization's drilling operations safety manual and, when appropriate, the drill rig manufacturer's operations and maintenance manual. The safety supervisor should assure that each new employee reads and understands the safety manual.

- Carefully instruct a new worker in drilling safety and observe the new worker's progress towards understanding safe operation practices.

- Observe the mental, emotional, and physical capability of each worker to perform the assigned work in a proper and safe manner. The safety supervisor should dismiss any worker from the drill site whose mental and physical capabilities might cause injury to the worker or coworkers.

- Assure that there is a first aid kit on each drill rig and a fire extinguisher on each drill rig and on each additional vehicle and assure that they are properly maintained.

- Be well trained, along with as many crew members as possible, and capable of using first aid kits, fire extinguishers, and all other safety devices and equipment.

- Maintain a list of addresses and telephone numbers of emergency assistance units (ambulance services, police, hospitals, etc.), and inform other members of the drill crew of the existence and location of the list.

4.0 INDIVIDUAL PROTECTIVE EQUIPMENT

For most geotechnical, mineral, and/or groundwater drilling projects, individual protective equipment should include a safety hat, safety shoes, safety glasses, and close-fitting gloves and clothing. The clothing of the individual drill rig worker is not generally considered protective equipment; however, your clothing should be close-fitting but comfortable, without loose ends,

straps, drawstrings, or belts, or otherwise unfastened parts that might catch on some rotating or translating component of the drill rig. Rings and jewelry should not be worn during a work shift.

- Safety Head Gear - Safety hats (hard hats) should be worn by everyone working or visiting at or near a drilling site. All safety hats should meet the requirements of ANSI Z89.1. All safety hats should be kept clean and in good repair with the headband and crown straps properly adjusted for the individual drill rig worker or visitor.

- Safety Shoes or Boots - Safety shoes or boots should be worn by all drilling personnel and all visitors to the drill site that observe drilling operations within close proximity of the drill rig. All safety shoes or boots should meet the requirements of ANSI Z41.1.

- Gloves - All drilling personnel should wear gloves for protection against cuts and abrasions which could occur while handling wire rope or cable and from contact with sharp edges and burrs on drill rods and other drilling or sampling tools. All gloves should be close-fitting and not have large cuffs or loose ties which can catch on rotating or translating components of the drill rig.

- Safety Glasses - All drilling personnel should wear safety glasses. All safety glasses should meet the requirements of ANSI Z87.1.

- Other Protective Equipment - For some drilling operations, the environment or regulations dictate that other protection equipment be used. The requirement for such equipment must be determined jointly by the management of the drilling organization and the safety supervisor. Such equipment might include face or ear protection or reflective clothing. Each drill worker should wear noise reducing ear protectors when appropriate. When drilling is performed in chemically or radiologically contaminated ground, special protective equipment and clothing may, and probably will, be required. The design and composition of the protective equipment and clothing should be determined as a joint effort of management and the client who requests the drilling services.

5.0 HOUSEKEEPING ON AND AROUND THE DRILL RIG

The first requirement for safe field operation is that the safety supervisor understands and fulfills the responsibility for maintenance and "housekeeping" on and around the drill rig.

- Suitable storage locations should be provided for all tools, materials, and supplies so that tools, materials, and supplies can be conveniently and safety handled without hitting or falling on a member of the drill crew or a visitor.

- Avoid storing or transporting tools, materials, or supplies within or on the mast (derrick) of the drill rig.

- Pipe, drill rods, casing, augers, and similar drilling tools should be orderly stacked on racks or sills to prevent spreading, rolling, or sliding.

- Penetration or other driving hammers should be placed at a safe location on the ground or be secured to prevent movement when not in use.

- Work areas, platforms, walkways, scaffolding, and other accessways should be kept free of materials, debris, and obstructions and substances such as ice, grease, or oil that could cause surfaces to become slick or otherwise hazardous.

- Keep all controls, control linkages, warning and operation lights, and lenses free of oil, grease, and/or ice.

- Do not store gasoline in any portable container other than a non-sparking, red container with flame arrester in the fill spout and having the word "gasoline" easily visible.

6.0 MAINTENANCE SAFETY

Good maintenance will make drilling operations safer. Also, maintenance should be performed safely.

- Wear safety glasses when performing maintenance on a drill rig or on drilling tools.

- Shut down the drill rig engine to make repairs or adjustments to a drill rig or to lubricate fittings (except repairs or adjustments that can only be made with the engine running). Take precautions to prevent accidental starting of an engine during maintenance by removing or tagging the ignition key.

- Always block the wheels or lower the leveling jacks, or both, and set hand brakes before working under a drill rig.

- When possible and appropriate, release all pressure on the hydraulic systems, the drilling fluid system, and the air pressure systems of the drill rig prior to performing maintenance. In other words, reduce the drill rig and operating systems to a "zero energy state" before performing maintenance. Use extreme caution when opening drain plugs and radiator caps and other pressurized plugs and caps.

- Do not touch an engine or the exhaust system of an engine following its operation until the engine or exhaust system has had adequate time to cool.

- Never weld or cut on or near a fuel tank.

- Do not use gasoline or other volatile or flammable liquids as a cleaning agent on or around a drill rig.

- Follow the manufacturer's recommendations for applying the proper quantity and quality of lubricants, hydraulic oils, and/or coolants.

- Replace all caps, filler plugs, protective guards or panels, high pressure hose clamps, and chains or cables that have been removed for maintenance before returning the drill rig to service.

7.0 SAFE USE OF HAND TOOLS

There are almost an infinite number of hand tools that can be used on or around a drill rig and in repair shops and more than an equal number of instructions for proper use. "Use the tool for its intended purpose" is the most important rule. The following are a few specific and some general suggestions which apply to safe use of several hand tools that are often used on and around drill rigs.

- When a tool becomes damaged, either repair it before using it again, or get rid of it.

- When using a hammer, any kind of hammer for any purpose, wear safety glasses and require all others around you to wear safety glasses.

- When using a chisel, any kind of chisel for any purpose, wear safety glasses and require all others around you to wear safety glasses.

- Keep all tools cleaned and orderly stored when not in use.

- Use wrenches on nuts -- do not use pliers on nuts.

- Use screwdrivers with blades that fit the screw slot.

- When using a wrench on a tight nut: first use some penetrating oil; use the largest wrench available that fits the nut; when possible pull on the wrench handle rather than pushing; and apply force to the wrench with both hands when possible and with both feet firmly placed. Do not push or pull with one or both feet on the drill rig or the side of a mud pit or some other blocking-off device. Always assume that you may lose your footing -- check the place where you may fall for sharp objects.

- Keep all pipe wrenches clean and in good repair. The jaws of pipe wrenches should be wire brushed frequently to prevent an accumulation of dirt and grease which would otherwise build up and cause wrenches to slip.

- Never use pipe wrenches in place of a rod holding device.

- Replace hook and heel jaws when they become visibly worn.

- When breaking tool joints on the ground or on a drilling platform, position your hands so that your fingers will not be smashed between the wrench handle and the ground or the platform should the wrench slip or joint suddenly let go.

8.0 CLEARING THE WORK AREA

Prior to drilling, adequate site clearing and leveling should be performed to accommodate the drill rig and supplies and provide a safe working area. Drilling should not be commenced when tree limbs, unstable ground, or site obstructions cause unsafe tool handling conditions.

9.0 START UP

All drill rig personnel and visitors should be instructed to "stand clear" of the drill rig immediately prior to and during starting of an engine.

Start all engines in accordance with the manufacturer's manual. Make sure all gears boxes are in neutral, all hoist levers are disengaged, all hydraulic levers are in the correct nonactuating positions, and the cathead rope is not on the cathead before starting a drill rig engine.

10.0 SAFETY DURING DRILLING OPERATIONS

Safety requires the attention and cooperation of every worker and site visitor.

- Do not drive the drill rig from hole to hole with the mast (derrick) in the raised position.

- Before raising the mast (derrick), look up to check for overhead obstructions. (Refer to Section 11.0 on Overhead and Buried Utilities).

- Before raising the mast (derrick), all drill rig personnel (with exception of the operator) and visitors should be cleared from the areas immediately to the rear and the sides of the mast. All drill rig personnel and visitors should be informed that the mast is being raised prior to raising it.

- Before starting drilling operations, secure and/or lock the mast (derrick), if required, according to the drill manufacturer's recommendations.

- The operator of a drill rig should only operate a drill rig from the position of the controls. If the operator of the drill rig must leave the area of the controls, the operator should shift the transmission controlling the rotary drive into neutral and place the feed control level in neutral. The operator should shut down the drill engine before leaving the vicinity of the drill.

- Throwing or dropping tools should not be permitted. All tools should be carefully passed by hand between personnel or a hoist line should be used.

- Do not consume alcoholic beverages or other depressants or chemical stimulants prior to starting work on a drill rig or while on the job.

- If it is necessary to drill within an enclosed area, make certain that exhaust fumes are conducted out of the area. Exhaust fumes can be toxic and some cannot be detected by smell.

- Clean mud and grease from your boots before mounting a drill platform and use handholds and railing. Watch for slippery ground when dismounting from the platform.

- During freezing weather, do not touch any metal parts of the drill rig with exposed flesh. Freezing of moist skin to metal can occur almost instantaneously.

- All air and water lines and pumps should be drained when not in use if freezing weather is expected.

- All unattended boreholes must be adequately covered or otherwise protected to prevent drill rig personnel, site visitors, or animals from stepping or falling into the hole. All open boreholes should be covered and protected or backfilled adequately and according to local and state regulations on completion of the drilling project.

- "Horsing around" within the vicinity of the drill rig and tool and supply storage areas should never be allowed; even when the drill rig is shut down.

- When using a ladder on a drill rig, face the ladder and grasp either the side rails or the rungs with both hands while ascending or descending. Do not attempt to use one or both hands to carry a tool while on a ladder. Use a hoist line and a tool "bucket" or a safety hook to raise or lower hand tools.

An elevated derrick platform should be used with the following precautions:

- When climbing the mast (derrick) or working on a derrick platform, use a safety belt or a lifeline. The safety belt should be at least 4 inches (100 mm) wide and should fit snugly, but comfortably. The lifeline, when attached to the derrick, should be less than 8 feet (2.5 m) long. The safety belt and lifeline should be strong enough to withstand the dynamic force of a 250 pound (115 kg) weight (contained within the belt) falling 8 feet (2.5 m).

- When a rig worker is on a derrick platform, the lifeline should be fastened to the derrick just above the derrick platform and to a structural member that is not attached to the platform or to other lines or cables supporting the platform.

- When a rig worker first arrives at a derrick platform, the platform should immediately be inspected for broken members, loose connections, and loose tools or other loose materials.

- Tools should be secured attached to the platform with safety lines. Do not attach a tool to a line attached to your wrist or any other part of your body.

- When you are working on a derrick platform, do not guide drill rods or pipe into racks or other supports by taking hold of a moving hoist line or a traveling block.

- Loose tools and similar items should not be left on the derrick platform or on structural members of the derrick.

- A derrick platform over 4 feet (1.2 m) above ground surface should have toe boards and safety railings that are in good condition.

- Workers on the ground or the drilling floor should avoid being under rig workers on elevated platforms, whenever possible.

Be careful when lifting heavy objects:

- Before lifting any object without using a hoist, make sure that the load is within your personal lifting capacity. If it is too heavy, ask for assistance.

- Before lifting a relatively heavy object, approach the object by bending at the knees, keeping your back vertical and unarched while obtaining a firm footing.

Grasp the object firmly with both hands and stand slowly and squarely while keeping your back vertical and unarched. In other words, perform the lifting with the muscles in your legs, not the muscles in your lower back.

- If a heavy object must be moved some distance without the aid of machinery, keep your back straight and unarched. Change directions by moving your feet, not by twisting your body.

- Move heavy objects with the aid of handcarts whenever possible.

Drilling operation should be terminated during an electrical storm, and the complete crew should move away from the drill rig.

11.0 OVERHEAD AND BURIED UTILITIES

The use of a drill rig on a site or project within the vicinity of electrical power lines and other utilities requires that special precautions be taken by both supervisors and members of the exploration crew. Electricity can shock, it can burn, and it can cause death.

- Overhead and buried utilities should be located, noted, and emphasized on all boring location plans and boring assignment sheets.

- When overhead electrical power lines exist at or near a drilling site or project, consider all wires to be alive and dangerous.

- Watch for sagging power lines before entering a site. Do not lift power lines to gain entrance. Call the utility and ask them to lift or raise the lines or de-energize (turn off) the power.

- Before raising the drill rig mast (derrick) on a site in the vicinity of power lines, walk completely around the drill rig. Determine what the minimum distance from any point on the drill rig to the nearest power line will be when the mast is raised and/or being raised. Do not raise the mast or operate the drill rig if this distance is less than 20 feet (6 m) or, if known, the minimum clearance stipulated by Federal, state, and local regulations.

- Keep in mind that both hoist lines and overhead power lines can be moved toward each other by the wind.

- In order to avoid contact with power lines, only move the drill rig with the mast (derrick) down.

- If there are any questions whatever concerning the safety of drilling sites in the vicinity of overhead power lines, call the power company. The power company will provide expert advice at the drilling site as a public service and at no cost.

Underground electricity is as dangerous as overhead electricity. Be aware and always suspect the existence of underground utilities such as electrical power, gas, petroleum, telephone, sewer, and water. Ask for assistance.

- If a sign warning of underground utilities is located on a site boundary, do not assume that underground utilities are located on or near the boundary or property line under the sign -- call the utility and check it out. The underground utilities may be a considerable distance away from the warning sign.

- Always contact the owners of utility lines or the nearest underground utility location service before drilling. Determine jointly with utility personnel the precise location of underground utility lines, mark and flag the locations, and determine jointly with utility personnel what specific precautions must be taken to assure safety.

12.0 SAFE USE OF ELECTRICITY

Drilling projects sometimes require around-the-clock operations and, therefore, require temporary electrical lighting. In general, all wiring and fixtures used to provide electricity for drilling operations should be installed by qualified personnel in accordance with the National Electrical Code (NFPA 70-1971) with consideration of the American Petroleum Institute's recommended practices for electrical installations for production facilities (API-RP-500B). Lights should be installed and positioned to assure that the work area and operating positions are well lit without shadows or blind spots. The following specific recommendations emphasize the safe use of electricity during landbased drilling operations.

- Before working on an electrical power or lighting system, lock out the main panel box with your own lock, and keep the key on your person at all times.

- All wiring should be installed using high-quality connections, fixtures, and wire which are insulated and protected with consideration of the drilling environment. Makeshift wiring and equipment should not be permitted.

- All lights positioned directed above working areas should be enclosed in cages or similar enclosures to prevent loose or detached lamps or vapor-tight enclosures from falling on workers.

- Lights should be installed to produce the least possible glare or "blind spots" on tools, ladders, walkways, platforms, and the complete working area.

- Electrical cables should be guarded and located to prevent damage by drilling operations or by the movement of personnel, tools, or supplies.

- All plug receptacles should be a three-prong, U-blade, grounded type, and have adequate current-carrying capacity for the electrical tools that may be used.

- All electrical tools should have three-prong, U-blade, ground wire plugs and cords.

- Do not use electrical tools with lock-on devices.

- All electrical welders, generators, control panels, and similar devices should be adequately grounded.

- Control panels, fuse boxes, transformers, and similar equipment should have a secure, protective enclosure.

- Avoid attaching electrical lighting cables to the derrick or other components of the drill rig. If this must be done, use only approved fasteners. Do not "string" wire through the derrick.

- Poles used to hold wiring and lights should not be used for any other purpose.

- Power should be turned off before changing fuses or light bulbs.

- When a drilling area is illuminated with electrical lighting, all workers should wear safety head gear that protects the workers' heads, not only against falling or flying objects, but also against limited electrical shock and burn according to ANSI Z89.1 and Z89.2.

- Electrical equipment should only be operated by trained, designated personnel.

- If you are not qualified to work on electrical devices or on electric lines, do not go near them.

13.0 REACT TO CONTACT WITH ELECTRICITY

If a drill makes contact with electrical wires, it may or may not be insulated from the ground by the tires of the carrier. Under either circumstance, the human body, if it simultaneously comes in contact with the drill rig and the ground, will provide a conductor of the electricity to

the ground. Death or serious injury can be the result. If a drill rig or a drill rig carrier makes contact with overhead or underground electrical lines:

- Under most circumstances, the operator and other personnel on the seat of the vehicle should remain seated and not leave the vehicle. Do not move or touch any part, particularly a metallic part, of the vehicle or the drill rig.

- If it is determined that the drill rig should be vacated, then all personnel should jump clear and as far as possible from the drill. Do not step off -- jump off; and do not hang onto the vehicle or any part oft he drill when jumping clear.

- If you are on the ground, stay away from the vehicle and the drill rig, do not let others get near the vehicle and the drill rig, and seek assistance from local emergency personnel, such as the police or fire department.

- When an individual is injured and in contact with the drill rig or with power lines, attempt rescue with extreme caution. If a rescue is attempted, use a long, dry, unpainted piece of wood or a long, dry, clean rope. Keep as far away from the victim as possible and do not touch the victim until the victim is completely clear of the drill rig or electrical lines.

- When the victim is completely clear of the electrical source and is unconscious and a heart beat (pulse) cannot be detected, begin cardiopulmonary resuscitation (CPR) immediately.

14.0 SAFE USE OF WIRE LINE HOISTS, WIRE ROPE, AND HOISTING HARDWARE

The use of wire line hoists, wire rope, and hoisting hardware should be as stipulated by the American Iron and Steel Institute Wire Rope Users Manual.

- All wire ropes and fittings should be visually inspected during use and thoroughly inspected at least once a week for: abrasion; broken wire; wear; reduction in rope diameter; reduction in wire diameter; fatigue; corrosion; damage from heat, improper reeving, jamming, crushing, bird caging, kinking, and core protrusion; and damage to lifting hardware. Wire ropes should be replaced when inspection indicates excessive damage according to the Wire Rope Users Manual. All wire ropes which have not been used for a period of 1 month or more should be thoroughly inspected before being returned to service.

- End fittings and connections consist of spliced eyes and various manufactured devices. All manufactured end fittings and connections should be installed according to the manufacturer's instructions and loaded according to the manufacturer's specifications.

- If a ball-bearing type hoisting swivel is used to hoist drill rods, swivel bearings should be inspected and lubricated daily to assure that the swivel freely rotates under load.

- If a rod slipping device is used to hoist drill rods, do not drill through or rotate drill rods through the slipping device, do not hoist more than 1 foot (0.3 m) of the drill rod column above the top of the mast (derrick), do not hoist a rod column with loose tool joints, and do not make up, tighten, or loosen tool joints while the rod column is being supported by a rod slipping device. If drill rods should slip back into the borehole, do not attempt to break the fall of the rods with your hands or by tensioning the slipping device.

- Most sheaves on exploration drill rigs are stationary with a single part line. The number of parts of line should never be increased without first consulting with the manufacturer of the drill rig.

- Wire ropes must be properly matched with each sheave -- if the rope is too large, the sheave will pinch the wire rope; if the rope is too small, it will groove the sheave. Once the sheave is grooved, it will severely pinch and damage larger sized wire ropes.

The following procedures and precautions must be understood and implemented for safe use of wire ropes and rigging hardware.

- Use tool handling hoists only for vertical lifting of tools (except when angle hole drilling). Do not use tool handling hoists to pull on objects away from the drill rig; however, drills may be moved using the main hoist if the wire rope is spooled through proper sheaves according to the manufacturer's recommendations.

- When stuck tools or similar loads cannot be raised with a hoist, disconnect the hoist line and connect the stuck tools directly to the feed mechanism of the drill. Do not use hydraulic leveling jacks for added pull to the hoist line of the feed mechanism of the drill.

- When attempting to pull out a mired-down vehicle or drill rig carrier, only use a winch on the front or rear of the vehicle and stay as far as possible away from the wire rope. Do not attempt to use tool hoists to pull out a mired-down vehicle or drill rig carrier.

- Minimize shock loading of a wire rope -- apply loads smoothly and steadily.

- Avoid sudden loading in cold weather.

- Never use frozen ropes.
- Protect wire rope from sharp corners or edges.
- Replace worn sheaves or worn sheave bearings.
- Replace damaged safety latches on safety hooks before using.
- Know the safe working load of the equipment and tackle being used. Never exceed this limit.
- Clutches and brakes of hoists should be periodically inspected and tested.
- Know, and do not exceed, the rated capacity of hooks, rings, links, swivels, shackles, and other lifting aids.
- Always wear gloves when handling wire rope.
- Do not guide wire rope on hoist drums with your hands.
- Following the installation of a new wire rope, first lift a light load to allow the wire rope to adjust.
- Never carry out any hoisting operations when the weather conditions are such that hazards to personnel, the public, or property are created.
- Never leave a load suspended in the air when the hoist is unattended.
- Keep your hands away from hoists, wire rope, hoisting hooks, sheaves, and pinch points as slack is being taken up and when the load is being hoisted.
- Never hoist the load over the head, body, or feet of any personnel.
- Never use a hoist line to "ride" up the mast (derrick) of a drill rig.
- Replacement wire ropes should conform to the drill rig manufacturer's specifications.

15.0 SAFE USE OF CATHEAD AND ROPE HOISTS

The following safety procedures should be employed when using a cathead hoist:

- Keep the cathead clean and free of rust and oil and/or grease. The cathead should be cleaned with a wire brush if it becomes rusty.

- Check the cathead periodically, when the engine is not running, for rope wear grooves. If a rope groove forms to a depth greater than 1/8 inch (3 mm), the cathead should be replaced.

- Always use a clean, dry, sound rope. A wet or oily rope may "grab" the cathead and cause drill tools or other items to be rapidly hoisted to the top of the mast.

- Should the rope "grab" the cathead or otherwise become tangled in the drum, release the rope and sound an appropriate alarm for all personnel to rapidly back away and stay clear. The operator should also back away and stay clear. If the rope "grabs" the cathead, and tools are hoisted to the sheaves at the top of the mast, the rope will often break, releasing the tools. If the rope does not break, stay clear of the drill rig until the operator cautiously returns to turn off the drill rig engine and appropriate action is taken to release the tools. The operator should keep careful watch on the suspended tools and should quickly back away after turning off the engine.

- The rope should always be protected from contact with all chemicals. Chemicals can cause deterioration of the rope that may not be visibly detectable.

- Never wrap the rope from the cathead (or any other rope, wire rope, or cable on the drill rig) around a hand, wrist, arm, foot, ankle, leg, or any other part of your body.

- Always maintain a minimum of 18 inches of clearance between the operating hand and the cathead drum when driving samplers, casing, or other tools with the cathead and rope method. Be aware that the rope advances toward the cathead with each hammer blow as the sampler or other drilling tool advances into the ground.

- Never operate a cathead (or perform any other task around the drill rig) with loose, unbuttoned, or otherwise unfastened clothing or when wearing gloves with large cuffs or loose straps or lacings.

- Do not use a rope that is any longer than necessary. A rope that is too long can form a ground loop or otherwise become entangled with the operator's legs.

- Do not use more rope wraps than are required to hoist a load.
- Do not leave a cathead unattended with the rope wrapped on the drum.
- Position all other hoist lines to prevent contact with the operating cathead rope.
- When using the cathead and rope for driving or back-driving, make sure that all threaded connections are tight and stay as far away as possible from the hammer impact point.
- The cathead operator must be able to operate the cathead standing on a level surface with good, firm footing conditions without distraction or disturbance.

16.0 SAFE USE OF AUGERS

The following general procedures should be used when starting a boring with continuous flight or hollow-stem augers.

- Prepare to start an auger boring with the drill rig level, the clutch or hydraulic rotation control disengaged, the transmission in low gear, and the engine running at low RPM.
- Apply an adequate amount of down pressure prior to rotation to seat the auger head below the ground surface.
- Look at the auger head while slowly engaging the clutch or rotation control and starting rotation. Stay clear of the auger.
- Slowly rotate the auger and auger head while continuing to apply down pressure. Keep one hand on the clutch or the rotation control at all times until the auger has penetrated about 1 foot or more below the ground surface.
- If the auger head slides out of alignment, disengage the clutch or hydraulic rotation control and repeat the hole starting process.
- An auger guide can facilitate the starting of a straight hole through hard ground or a pavement.

The operator and tool handler should establish a system of responsibility for the series of various activities required for auger drilling, such as connecting and disconnecting auger sections, and inserting and removing the auger fork. The operator must assure that the tool handler is well away from the auger column and that the auger fork is removed before starting rotation.

- Only use the manufacturer's recommended method of securing the auger to the power coupling. Do not touch the coupling or the auger with your hands, a wrench, or any other tools during rotation.

- Whenever possible, use tool hoists to handle auger sections.

- Never place hands or fingers under the bottom of an auger section when hoisting the auger over the top of the auger section in the ground or other hard surfaces such as the drill rig platform.

- Never allow feet to get under the auger section that is being hoisted.

- When rotating augers, stay clear of the rotating auger and other rotating components of the drill rig. Never reach behind or around a rotating auger for any reason whatever.

- Use a long-handled shovel to move auger cuttings away from the auger. Never use hands or feet to move cuttings away from the auger.

- Do not use hands to remove earth from rotating augers when removing augers from the ground.

17.0 SAFETY DURING ROTARY AND CORE DRILLING

Rotary drilling tools should be safety checked prior to drilling.

- Water swivels and hoisting plugs should be lubricated and checked for "frozen" bearings before use.

- Drill rod chuck jaws should be checked periodically and replaced when necessary.

- The capacities of hoists and sheaves should be checked against the anticipated weight of the drill rod string plus other expected hoisting loads.

The following special precautions should be taken for safe rotary or core drilling which involves chucking, joint break, hoisting, and lowering of drill rods.

- Only the operator of the drill rig should brake or set a manual chuck so that rotation of the chuck will not occur prior to removing the wrench from the chuck.

- Drill rods should not be braked during lowering into the hole with drill rod chuck jaws.

- Drill rods should not be held or lowered in the hole with pipe wrenches.

- If a string of drill rods are accidentally or inadvertently released into the hole, do not attempt to grab the falling rods with your hands or a wrench.

- In the event of a plugged bit or other circulation blockage, the high pressure in the piping and hose between the pump and the obstruction should be relieved or bled down before breaking the first tool joint.

- When drill rods are hoisted from the hole, they should be cleaned for safe handling with a rubber or other suitable rod wiper. Do not use your hands to clean drilling fluids from drill rods.

- If work must progress over a portable drilling fluid (mud) pit, do not attempt to stand on narrow sides or cross-members. The mud pit should be equipped with rough surfaced, fitted cover panels of adequate strength to hold drill rig personnel.

- Drill rods should not be lifted and leaned unsecured against the mast. Either provide some method of securing the upper ends of the drill rod sections for safe vertical storage or lay the rods down.

18.0 SAFETY DURING TRAVEL

The individual who transports the drill rig on and off a drilling site should:

- Be properly licensed and should only operate a vehicle according to Federal, state, and local regulations.

- Know the traveling height (overhead clearance), width, length, and weight of the drill rig with carrier and know highway and bridge load, width, and overhead limits, making sure these limits are not exceeded with an adequate margin.

- Never move a drill rig unless the vehicle brakes are in sound working order.

- Allow for mast overhang when cornering or approaching other vehicles or structures.

- Be aware that the canopies of service stations and motels are often too low for a drill rig mast to clear with the mast in the travel position.

- Watch for low hanging electrical lines, particularly at the entrances to drilling sites or restaurants, motels, or other commercial sites.

- Never travel on a street, road, or highway with the mast (derrick) of the drill rig in the raised or partially raised position.

- Remove all ignition keys when a drill rig is left unattended.

19.0 LOADING AND UNLOADING

When loading or unloading a drill rig on a trailer or a truck:

- Use ramps of adequate design that are solid and substantial enough to bear the weight of the drill rig with carrier -- including tooling.

- Load and unload on level ground.

- Use the assistance of someone on the ground as a guide.

- Check the brakes on the drill rig carrier before approaching loading ramps.

- Distribute the weight of the drill rig, carrier, and tools on the trailer so that the center of weight is approximately on the centerline of the trailer and so that some of the trailer load is transferred to the hitch of the pulling vehicle. Refer to the trailer manufacturer's weight distribution recommendations.

- The drill rig and tools should be secured to the hauling vehicle with ties, chains, and/or load binders of adequate capacity.

20.0 OFF-ROAD MOVEMENT

The following safety suggestions relate to off-load movement:

- Before moving a drill rig, first walk the route of travel, inspecting for depressions, stumps, gullies, ruts, and similar obstacles.

- Always check the brakes of the drill rig carrier before traveling, particularly on rough, uneven, or hilly ground.

- Check the complete drive train of a carrier at least weekly for loose or damaged bolts, nuts, studs, shafts, and mounting.

- Discharge all passengers before moving a drill rig on rough or hilly terrain.

- Engage the front axle (for 4 x 4, 6 x 6, etc. vehicles or carriers) when traveling off-highway on hilly terrain.

- Use caution when traveling side-hill. Conservatively evaluate side-hill capability of drill rigs because the arbitrary addition of drilling tools may raise the center of mass. When possible, travel directly uphill or downhill. Increase tire pressures before traveling in hilly terrain (do not exceed rated tire pressure).

- Attempt to cross obstacles such as small logs and small erosion channels or ditches squarely, not at an angle.

- Use the assistance of someone on the ground as a guide when lateral or overhead clearance is close.

- After the drill has been moved to a new drilling site, set all brakes and/or locks. When grades are steep, block the wheels.

- Never travel off-road with the mast (derrick) of the drill rig in the raised or partially raised position.

21.0 TIRES, BATTERIES, AND FUEL

Tires on the drill rig must be checked daily for safety and during extended travel for loss of air; and they must be maintained and/or repaired in a safe manner. If tires are deflated to reduce ground pressure for movement on soft ground, the tires should be reinflated to normal pressures before movement on firm or hilly ground or on streets, roads, and highways. Underinflated tires are not as stable on firm ground as properly inflated tires. Air pressures should be maintained for travel on streets, roads, and highways according to the manufacturer's recommendations. During air pressure checks, inspect for:

- Missing or loose wheel lugs.

- Objects wedged between duals or embedded in the tire casing.

- Damaged or poorly fitting rims or rim flanges.

- Abnormal or uneven wear and cuts, breaks, or tears in the casing.

The repair of truck and off-highway tires should only be made with required special tools and following the recommendations of a tire manufacturer's repair manual.

Batteries contain strong acid. Use extreme caution when servicing batteries.

- Batteries should only be serviced in a ventilated area while wearing safety glasses.
- When a battery is removed from a vehicle or service unit, disconnect the battery ground clamp first.
- When installing a battery, connect the battery ground clamp last.
- When charging a battery with a battery charger, turn off the power source to the battery before either connecting or disconnecting charger leads to the battery posts. Cell caps should be loosened prior to charging to permit the escape of gas.
- Spilled battery acid can burn your skin and damage your eyes. Spilled battery acid should be immediately flushed off your skin with lots of water. Should battery acid get into someone's eyes, flush immediately with large amounts of water and see a medical physician at once.
- To avoid battery explosions, keep the cells filled with electrolyte, use a flashlight (not an open flame) to check electrolyte levels and avoid creating sparks around the battery by shorting across a battery terminal. Keep lighted smoking materials and flames away from batteries.

Special precautions must be taken for handling fuel and refueling the drill rig or carrier.

- Only use the type and quality of fuel recommended by the engine manufacturer.
- Refuel in a well-ventilated area.
- Do not fill fuel tanks while the engine is running. Turn off all electrical switches.
- Do not spill fuel on hot surfaces. Clean any spillage before starting an engine.
- Wipe up spilled fuel with cotton rags or cloths -- do not use wool or metallic cloth.
- Keep open lights, lighted smoking materials, and flames or sparking equipment well away from the fueling area.
- Turn off heaters in carrier cabs when refueling the carrier or the drill rig.

- Do not fill portable fuel containers completely full to allow expansion of the fuel during temperature changes.

- Keep the fuel nozzle in contact with the tank being filled to prevent static sparks from igniting the fuel.

- Do not transport portable fuel containers in the vehicle or carrier cab with personnel.

- Fuel containers and hoses should remain in contact with a metal surface during travel to prevent the build-up of static charge.

22.0 FIRST AID

At least one member of the drill crew, and if only one, preferably the drilling and safety supervisor, should be trained to perform first aid. First aid is taught on a person-to-person basis, not by providing or reading a manual. Manuals should only provide continuing reminders and be used for reference. It is suggested that courses provided or sponsored by the American Red Cross or a similar organization would best satisfy the requirements of first aid training for drill crews.

For drilling operations it is particularly important that the individual responsible for first aid should be able to recognize the symptoms and be able to provide first aid for electrical shock, heart attack, stroke, broken bones, eye injury, snake bite, and cuts or abrasions to the skin. Again, first aid for these situations is best taught to drill crew members by instructors qualified by an agency such as the American Red Cross.

A first aid kit should be available and well-maintained on each drill site.

23.0 DRILL RIG UTILIZATION

Do not attempt to exceed manufacturers' ratings of speed, force, torque, pressure, flow, etc. Only use the drill rig and tools for the purposes which they are intended and designed.

24.0 DRILL RIG ALTERATIONS

Alterations to a drill rig or drilling tools should only be made by qualified personnel and only after consultation with the manufacturer.

APPENDIX F

PROJECT FORMS

INCIDENT NARRATIVE

Incident involved:

1. _____ First aid
   _____ Environmental release
   _____ Property damage
   _____ Near miss

2. Any personnel involved? _____ If so, who?
   _____
   Job Title/Function? _____
   How long employed? _____

3. Provide brief narrative of incident/suspected cause.

   _____

   _____

   _____

   _____

4. Divisional Health and Safety Representative Evaluation:

   Detail causes of incident.

   _____

   _____

   _____

   Recommendations to prevent recurrence.

   _____

   _____

   _____

DAILY SAFETY MEETING

Division/Subsidiary: _____ Facility: _____
Date: _____ Time: _____ Job Number: _____
Customer: _____
Specific Location: _____
Type of Work: _____
Chemicals Used: _____

SAFETY TOPICS PRESENTED

Protective Clothing/Equipment: _____
_____
Chemical Hazards: _____
_____
Physical Hazards: _____
_____
Summary of Work: _____
_____
_____
_____
_____
Other: _____
_____
_____

ATTENDEES

Name Printed	Signature

Meeting Conducted By:

_____ _____
Name Printed Signature
Supervisor: _____ Manager: _____

HEALTH AND SAFETY DAILY REPORT

_____
Project Name

Report Number: _____ Date: _____

A. Operation(s) Performed	**Approx. Time Spent (1/2 Hour)**
1. _____	_____
2. _____	_____
3. _____	_____
4. _____	_____
5. _____	_____

B. Crew Names and Titles	**Coveralls**	**Gloves**	**Respirator**
1. _____	_____	_____	_____
2. _____	_____	_____	_____
3. _____	_____	_____	_____
4. _____	_____	_____	_____
5. _____	_____	_____	_____

C. Monitoring Equipment Used	**Range**	**Average Reading**
1. _____	_____	_____
2. _____	_____	_____
3. _____	_____	_____
4. _____	_____	_____
5. _____	_____	_____

Note: Please ensure that the items listed in Sections B and C correspond to the operation number listed in Section A. Use additional sheets if necessary.

D. Environmental Conditions

Wind Speed	_____
Wind Direction	_____
Temperature	_____
Other	_____

TRAINING DOCUMENTATION				
Employee Name	Date of 40-Hour Introductory Training	Date of Last 8-Hour Refresher	Date of Supervisory Training if applicable	Date of Site-Specific Training Session (to be completed by HSO)

_____ certifies that the above information is accurate for all personnel.

_____

Signature of HSO

_____

Date

MEDICAL DATA SHEET

Name: _____ Home Telephone: _____

Address:

_____

Age: _____ Height: _____ Weight: _____

Next of Kin: _____ Telephone: _____

Drugs or Other Allergies: _____

_____

_____

Previous Illnesses or Exposure to Hazardous Substances: _____

_____

_____

Current Use of Medication (prescription and non-prescription): _____

_____

_____

Medical Restrictions: _____

_____

_____

Any Other Pertinent Data: _____

_____

_____

Name/Address/Telephone Number of Personal Physician: _____

_____

_____

The purpose of this form is to provide information to the attending physician in the event of an incident or occupational exposure. As such, it must be completed prior to field work and must accompany the injured/ill person to the emergency facility.

RESPIRATOR FIT TEST WORKSHEET

EMPLOYEE NAME: _____ SOCIAL SECURITY NO. _____

AWD OFFICE: _____ SITE LOCATION: _____ TEST DATE: _____

	RESPIRATOR 1	RESPIRATOR 2	RESPIRATOR 3
EQUIPMENT TYPE:			
MANUFACTURER'S NAME:			
MODEL:			
SIZE:			

TEST RESULTS	RESPIRATOR 1	RESPIRATOR 2	RESPIRATOR 3
(1) Negative Pressure Test	P ( ) F ( )	P ( ) F ( )	P ( ) F ( )
(2) Positive Pressure Test	P ( ) F ( )	P ( ) F ( )	P ( ) F ( )
(3) Isoamyl Acetate Vapor Test	P ( ) F ( )	P ( ) F ( )	P ( ) F ( )
(4) Irritant Smoke Test	P ( ) F ( )	P ( ) F ( )	P ( ) F ( )

Employee briefed on fundamental principles of respiratory protection, use, inspection, cleaning, maintenance, and storage of equipment.

Yes ( ) No ( )

ADDITIONAL INFORMATION

Most recent employee physical examination conducted on _____

Corrective lenses required for normal work tasks Yes ( ) No ( )

Facial characteristics preventing seal
(beard, missing dentures, etc.)? Yes ( ) No ( )

I hereby certify that the subject employee has been FIT tested according to procedures specified in AWD SOP HS2.1, Appendix A. The results of the test indicate that the subject employee is accepted ( ) rejected ( ) for work assignments requiring respiratory protective devices.

_____ _____ _____
Examiner's Name (Please Print) Examiner's Signature Date

_____ _____
Employee's Signature Date

AWD EMPLOYEE INJURY/ILLNESS REPORT

This is an official document to be initiated by the employee's supervisor. Please answer all questions completely. This report must be forwarded to the HSSO, DHSR, CHSM, and Personnel within 48 hours of the incident.

Injured's Name _____ Sex ____ S.S. No. _____ Birth Date _____

Home Address _____ City _____ State ____ Zip _____ Phone _____

Job Title _____ Employee No. _____ Hire Date _____ Hourly Wage _____

SUPERVISOR

Date of Incident _____ Time _____ Time/Reported _____ To Whom _____

Client Name _____ Client Address _____ Time Shift Began _____

Exact Location of Incident _____ Did Employee Leave Work? ☐ No ☐ Yes When _____

Has Employee Returned to Work? ☐No ☐Yes When ____ Did Employee Miss a Regular Scheduled Shift ☐No ☐Yes

Doctor/Hospital Name _____ Address _____

Witness Name(s) _____ Statements Attached? ☐ No ☐ Yes

Nature of Injury _____ Exact Body Part _____
(Attach Doctor's Report)

Medical Attention: ☐ None ☐ First Aid Onsite ☐ Doctor's Office ☐ Hospital E/R ☐ Hospitalized

Job Assignment at Time of Incident _____ Job _____ Phase _____ Task _____ Subtask _____

Describe Incident (Use separate sheet if necessary) _____

What was the Employee doing when the Incident Occurred? _____

What Object, Substance, Machine, or Tools were Directly Involved in the Incident _____

What Unsafe Physical Conditions or Unsafe Act Caused the Incident? _____

What Corrective Action has been Taken to Prevent Recurrence? _____

Supervisor/Foreman _____ _____ _____
(Print) Signature Date

PROJECT MANAGER

Comments on Incident and Corrective Action _____

Project Manager's Name _____ _____ _____
(Print) Signature Date

HEALTH AND SAFETY SITE OFFICER

Concur with Action Taken ☐ No ☐ Yes Remarks _____

OSHA Classification

☐ Incident Only ☐ First-Aid ☐ No Lost Workdays ☐ Lost Workdays ☐ Restricted Activity ☐ Fatal

Days Away From Work _____ Days Restricted Work _____ Total Days Charged _____

Name: _____ _____ _____
(Print) Signature Date

HEALTH AND SAFETY PLAN COMPLIANCE AGREEMENT

I, _____ (print name), have received a copy of the Health and Safety Plan for the _____ (Project No. _____). I have read the plan, understand it, and agree to comply with all of its provisions. I understand that I could be prohibited from working on the project and may be subject to disciplinary actions for violating any of the safety requirements specified in the Health and Safety Plan for conducting myself in an unprofessional manner.

_____

Name (Print)

_____ _____

Signature Date